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# CHILDREN'S BODY MEASUREMENTS

## FOR SIZING GARMENTS AND PATTERNS

U. S. DEPARTMENT OF AGRICULTURE  
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UNITED STATES DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION NO. 365

# Children's Body Measurements for Sizing Garments and Patterns

A proposed standard system based on  
height and girth of hips

*by Ruth O'Brien, chief*  
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TEXTILES AND CLOTHING DIVISION  
BUREAU OF HOME ECONOMICS



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## Foreword

The proposed standard system of children's body measurements suggested here is the result of many months' study by statisticians of 4,917,052 body measurements taken on 133,807 American boys and girls as part of a cooperative Works Progress Administration research project, initiated and led by the Bureau of Home Economics of the United States Department of Agriculture. A complete technical report of the study is now in preparation.

Eighteen colleges, universities, and other educational institutions helped in this research by giving the part-time services of one of their teachers who arranged local training schools for measurers, obtained permission to measure children in various counties in their States, and assisted in supervision.

Acknowledgment is here given to these cooperators:

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LOUISE STANLEY,  
*Chief, Bureau of Home Economics.*





# Contents

	Page
Need for scientific measurements . . . . .	1
Measurements included in the study . . . . .	1
Number of children measured . . . . .	1
Age, the poorest predictor of body dimensions . . . . .	2
Combination of a body length and a girth needed . . . . .	4
Height and hip measure recommended as basis for sizes . . . . .	6
Proposed standard system based on height and hip measure . . . . .	7
Proposed system not based on age . . . . .	18
Appendix . . . . .	19
Measurements and methods of taking them . . . . .	19



# Children's Body Measurements for Sizing Garments and Patterns

## *Need for Scientific Measurements*

The rapid growth of the pattern and ready-to-wear industry in the United States has brought with it many difficulties in the proper sizing of garments and patterns, especially those manufactured for women and children. Any satisfactory American sizing system must be based on dimensions obtained by measuring large numbers of persons throughout the country. Each measurement must be made in exactly the same way by individuals carefully trained in a method that can be duplicated. The same kind of instruments must be used, and these must be constantly checked so that they are accurate.

Unfortunately no such large, scientific study of the body measurements used in the construction of women's and children's garments has ever been reported. When funds were made available by the Works Progress Administration in 1937, the Bureau of Home Economics, therefore, organized and directed such a cooperative research project. The measurements used in the construction of trunk garments were taken on 147,088 children, 4 to 17 years of age, inclusive, distributed in 15 States and the District of Columbia.

This proposed standard of body measurements is based on the results of that study. It recommends dimensions to be used in constructing a series of standard mannequins such as are used by manufacturers to size garments and patterns. The measurements were taken next to the skin. The proposed standard, therefore, does not give garment and pattern dimensions. Standards for these can be developed from this proposed basis by agreement in the trade on tolerances for construction, style, and other clothing features.

## *Measurements Included in the Study*

The 36 measurements made on each child were chosen after consultation with retailers and garment and pattern manufacturers. These measurements are listed in the appendix (p. 19), together with a description of the method used in taking each. The boys wore trunks and the girls trunks and bandeaux. Men measured boys and women measured girls. Measurers were trained in the particular methods they were to use, and every possible precaution was taken to see that all measurements were made accurately and in the same way with reliable, calibrated instruments.

The first plan was to include measurements of feet, hands, and heads as the basis for sizing shoes, gloves, and hats. This idea had to be abandoned, however. Trials showed that such a large number of measurements fatigued the children too much. The results were inaccurate, and school authorities were unwilling to grant permission to measure a large group of children more than once. The list was therefore restricted to weight and the measurements used in making garments worn on the trunk of the body. The age range included in the study was limited by the funds available. The ages 4 to 17 were chosen because large groups of children of these ages could be reached in the schools, thus reducing the time and expense involved.

## *Number of Children Measured*

Although 147,088 children were measured, the size system proposed here is based on measurements obtained on 133,807 children (69,661 boys

and 64,146 girls) which was the number of complete records available when this part of the study was started. The distribution by States is shown in table 1. Some parts of the country are not represented. The taking of measurements depended on the cooperation of local institutions that would act as sponsors, and on school boards and other authorities willing to allow children to be measured. Unfortunately, such cooperation could not be secured in all sections of the country.

TABLE 1.—*Number of children by States*

State	Boys	Girls	Total
Alabama.....	4, 106	4, 446	8, 552
California.....	2, 625	2, 484	5, 109
Colorado.....	4, 303	4, 302	8, 605
District of Columbia and Maryland.....	6, 521	5, 244	11, 765
Illinois.....	6, 978	6, 581	13, 559
Iowa.....	3, 961	4, 010	7, 971
Kansas.....	3, 513	4, 240	7, 753
Michigan.....	6, 836	3, 754	10, 600
Minnesota.....	5, 672	5, 969	11, 641
Nebraska.....	3, 510	3, 539	7, 049
Ohio.....	7, 808	3, 774	11, 582
Pennsylvania.....	3, 249	4, 198	7, 447
Tennessee.....	2, 918	2, 899	5, 817
Texas.....	3, 514	4, 046	7, 560
Utah.....	4, 137	4, 660	8, 797
Total.....	69, 661	64, 146	133, 807

### *Age, the Poorest Predictor of Body Dimensions*

Essentially the problem of sizing garments is one of finding that measurement or combination of measurements which best predicts the other dimensions of a child's body. This is especially true when what is required is the creation of a representative form or model upon which standard garments may be manufactured. It follows, therefore, that the best choice is that measurement or combination of measurements which is most closely related to the greatest number of the others, provided, of course, it also satisfies the further criterion of being practicable.

Age is now used as a basis for sizing practically all children's garments and patterns, and many persons have surmised that this is the underlying cause of size difficulties. A great many children of exactly the same age have entirely different

dimensions and body proportions. The first step in this study was therefore to check this point and to determine by a statistical analysis of the measurements obtained what basis is best.

Briefly, three independent samples from the records were used for this analysis. Two of these included approximately 8,000 children each, and one 16,000. Each of these three samples gave similar results. The analysis was carried out separately for boys and for girls. Eighteen important body measurements in addition to age and weight were selected for study. The correlation coefficient was calculated for the 190 possible pairs of the 20 items. In general terms the correlation coefficient is an index which measures the closeness with which one measurement can be predicted from another. The correlation coefficient never exceeds unity; and the nearer to one it is, the more highly the two measurements are related.

Tables 2 and 3 were obtained by combining the three samples upon which the analysis was carried out separately. Table 2 gives the correlations of each of the 20 items with every other item for a sample of 32,165 boys, aged 4 to 14, and table 3 gives similar correlations for 31,919 girls, aged 4 to 14. For example, column 2 in these tables gives the correlation of age (in months) with every other measurement, and column 3 gives the correlation of waist height with every other measurement.

Note that on the whole the set of correlations in column 2 is smaller than the sets in any other column. Thus, of the entire set, age is the least highly correlated with all the other measurements. Note also that on the whole, lengths are more highly correlated with other lengths than with girths and that girths are more highly correlated with other girths than with lengths. It should be pointed out, however, that from a statistical point of view the close relationship found between two lengths is not so significant when one of the lengths forms part of the other as when they are independent of each other. An example of the first would be stature and hip height, and of the second stature and length of arm.

TABLE 2.—Intercorrelations of 20 measurements on a sample of 32,165 boys aged 4-14

	Age	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth	Waist girth	Hip girth	Neck-base girth	Armseye girth	Upper-arm girth	Posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Crotch length	Vertical trunk girth
Age					0.897															
Waist height	0.899					0.898	0.879	0.826	0.813	0.690	0.807	0.760	0.823	0.688	0.887	0.736	0.785	0.812	0.799	0.848
Hip height	.900	.991				.915	.990	.991	.977	.909	.886	.777	.896	.841	.891	.766	.974	.824	.864	.901
Weight	.822	.915	.901			.985	.986	.978	.894	.875	.764	.881	.828	.881	.750	.973	.808	.852	.890	.873
Stature	.897	.990	.985	.927		.927	.926	.897	.961	.958	.903	.975	.888	.943	.912	.937	.948	.947	.933	.961
Cervicale height	.898	.991	.986	.926	.996		.996	.972	.918	.896	.782	.904	.857	.901	.776	.973	.828	.875	.907	.951
Tibiale height	.879	.977	.978	.897	.972	.973		.973	.890	.870	.767	.875	.824	.872	.750	.960	.852	.900	.866	.909
Bitrochanteric diam.	.826	.909	.894	.961	.918	.918	.890		.931	.875	.973	.861	.921	.880	.907	.921	.928	.935	.914	.938
Chest girth	.813	.886	.875	.958	.896	.895	.870	.931		.900	.946	.879	.930	.899	.891	.911	.917	.918	.898	.932
Waist girth	.690	.777	.764	.903	.782	.783	.767	.875	.900		.909	.807	.856	.879	.782	.900	.870	.868	.836	.849
Hip girth	.807	.896	.881	.975	.904	.904	.877	.973	.946	.909		.868	.932	.922	.893	.964	.947	.952	.930	.944
Neck-base girth	.760	.841	.828	.888	.857	.851	.824	.861	.879	.807	.868		.878	.810	.845	.821	.846	.850	.849	.885
Armseye girth	.823	.891	.881	.943	.901	.900	.872	.921	.930	.856	.932	.878		.889	.898	.894	.902	.908	.891	.930
Upper-arm girth	.688	.766	.750	.912	.776	.775	.750	.880	.899	.879	.922	.810	.889		.771	.936	.900	.877	.845	.855
Posterior arm length	.887	.974	.973	.914	.973	.974	.960	.907	.891	.782	.893	.845	.898	.771		.821	.861	.895	.882	.924
Thigh girth	.736	.824	.808	.937	.828	.828	.806	.921	.911	.900	.964	.821	.894	.936	.821		.931	.917	.882	.886
Maximum calf girth	.785	.864	.852	.948	.875	.873	.852	.928	.917	.870	.947	.846	.902	.900	.861	.931		.936	.892	.912
Knee girth	.812	.901	.890	.947	.907	.906	.900	.935	.918	.868	.952	.850	.908	.877	.895	.917	.936		.903	.924
Crotch length	.799	.904	.873	.933	.903	.901	.866	.914	.898	.836	.930	.849	.891	.845	.882	.882	.892	.903		.942
Vertical trunk girth	.848	.933	.916	.961	.951	.949	.909	.938	.932	.849	.944	.885	.930	.855	.924	.886	.912	.924		

TABLE 3.—Intercorrelations of 20 measurements on a sample of 31,919 girls aged 4-14

	Age	Waist height	Hip height	Weight	Stature	Cervicale height	Tibiale height	Bitrochanteric diameter	Chest girth	Waist girth	Hip girth	Neck-base girth	Armseye girth	Upper-arm girth	Posterior arm length	Thigh girth	Maximum calf girth	Knee girth	Crotch length	Vertical trunk girth
Age																				
Waist height	0.915					0.921	0.890	0.857	0.826	0.673	0.840	0.799	0.823	0.692	0.909	0.765	0.800	0.823	0.826	0.885
Hip height	.908	.989				.982	.982	.974	.881	.856	.727	.871	.833	.856	.724	.971	.804	.834	.872	.862
Weight	.843	.906	.884			.915	.916	.878	.967	.961	.889	.983	.889	.939	.910	.904	.955	.948	.948	.960
Stature	.921	.990	.982	.915		.996	.968	.915	.881	.744	.902	.852	.881	.752	.974	.830	.862	.893	.895	.952
Cervicale height	.921	.991	.982	.916	.996		.968	.916	.882	.747	.904	.856	.882	.755	.974	.832	.862	.892	.896	.951
Tibiale height	.890	.974	.974	.878	.968	.968		.876	.850	.728	.866	.827	.849	.726	.957	.803	.833	.878	.854	.902
Bitrochanteric diam.	.857	.904	.881	.967	.915	.916	.876		.937	.852	.979	.865	.916	.872	.902	.931	.920	.931	.920	.947
Chest girth	.826	.875	.856	.961	.881	.882	.850	.937		.895	.953	.871	.927	.897	.877	.929	.916	.918	.903	.928
Waist girth	.673	.746	.727	.889	.744	.747	.728	.852	.895		.886	.787	.850	.881	.747	.896	.855	.854	.826	.823
Hip girth	.840	.895	.871	.983	.902	.904	.866	.979	.953	.886		.875	.931	.913	.892	.967	.944	.949	.937	.952
Neck-base girth	.799	.852	.833	.889	.852	.856	.827	.865	.871	.787	.875		.862	.795	.849	.839	.846	.857	.852	.881
Armseye girth	.823	.877	.856	.939	.881	.882	.849	.916	.927	.850	.931	.862		.885	.880	.907	.896	.903	.893	.920
Upper-arm girth	.692	.751	.724	.910	.752	.755	.726	.872	.897	.881	.913	.795	.885		.751	.939	.899	.880	.850	.842
Posterior arm length	.909	.975	.971	.904	.974	.974	.957	.902	.877	.747	.892	.849	.880	.751		.824	.850	.883	.875	.925
Thigh girth	.765	.828	.804	.955	.830	.832	.803	.931	.929	.896	.967	.839	.907	.939	.824		.937	.929	.903	.901
Maximum calf girth	.800	.854	.834	.948	.862	.862	.833	.920	.916	.855	.944	.846	.896	.899	.850	.937		.937	.892	.908
Knee girth	.823	.890	.872	.948	.893	.892	.878	.931	.918	.854	.949	.857	.903	.880	.883	.929	.937		.906	.921
Crotch length	.826	.901	.862	.936	.895	.896	.854	.920	.903	.826	.937	.852	.893	.850	.875	.903	.892	.906		.945
Vertical trunk girth	.885	.937	.912	.960	.952	.951	.902	.947	.928	.823	.953	.881	.920	.842	.925	.901	.908	.921		

In order to put age on a relative basis with other measurements, it was taken in combination with each one of seven important measurements and its percentage contribution to the prediction of the other 18 measurements calculated. Table 4 gives

the results obtained on the basis of age and height (stature), and age and girth of hips. The percentage contribution of age in the prediction of all the other measurements is almost negligible as compared with that of stature. In predicting other

TABLE 4.—Percentage contribution of age in predicting body measurements in contrast to the contribution of stature or of hip girth

Measurements to be predicted	Boys				Girls			
	Age versus stature		Age versus hip girth		Age versus stature		Age versus hip girth	
	Age	Stature	Age	Hip girth	Age	Stature	Age	Hip girth
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Waist height.....	5.2	94.8	50.7	49.3	2.2	97.8	56.5	43.5
Hip height.....	8.5	91.5	55.1	44.9	2.4	97.6	61.8	38.2
Weight.....	4.8	95.2	10.4	89.6	.4	99.6	5.8	94.2
Stature.....			48.2	51.8			55.9	44.1
Cervicale height.....	2.2	97.8	48.5	51.5	2.2	97.8	55.3	44.7
Tibiale height.....	3.3	96.7	50.3	49.7	.8	99.2	57.7	42.3
Bitrochanteric diameter.....	1.1	98.9	11.8	88.2	10.4	89.6	11.6	88.4
Chest girth.....	5.5	94.5	14.6	85.4	10.9	89.1	9.1	90.9
Waist girth.....	6.9	93.1	11.0	89.0	8.5	91.5	18.3	81.7
Hip girth.....	2.7	97.3			7.0	93.0		
Neck-base girth.....	5.0	95.0	18.8	81.2	10.7	89.3	23.8	76.2
Armscye girth.....	7.8	92.2	20.9	79.1	8.3	91.7	14.3	85.7
Upper-arm girth.....	5.1	94.9	13.2	86.8	.5	99.5	18.5	81.5
Posterior arm length.....	7.3	92.7	48.4	51.6	8.3	91.7	55.6	44.4
Thigh girth.....	4.1	95.9	10.1	89.9	.8	99.2	12.8	87.2
Maximum calf girth.....	.1	99.9	6.4	93.6	5.1	94.9	2.3	97.7
Knee girth.....	1.1	98.9	13.1	86.9	1.0	99.0	9.0	91.0
Crotch length.....	5.5	94.5	14.7	85.3	1.4	98.6	13.5	86.5
Vertical trunk girth.....	2.4	97.6	25.1	74.9	5.7	94.3	28.8	71.2

girths. age contributes much less than hip girth. This is true for both boys and girls. This fact, when taken in conjunction with the results of tables 2 and 3, shows that a system of sizing much superior to that of age can be found.

A study of a more technical nature showed that if only one measurement were to be used as a basis for garment and pattern sizes, weight is the best one, girth of hips is second best, and age is the most unreliable.

### *Combination of a Body Length and a Girth Needed*

Though weight or girth of hips, alone, is a fairly good measurement for sizing, neither is sufficient by itself to explain the variation of all the other measurements, especially the lengths. This is apparent from figures 1 and 2 which show the great variation in height for a given hip girth.

An analysis was next undertaken, therefore, to determine which combination of two measurements would best predict the other measurements of the set. To this end, 8 of the 20 measurements were chosen which in combination seemed likely to be good measurements for the purpose of sizing

garments. The 8 items chosen were: Waist height, weight, stature (i. e., height), girth of chest at the armscye, girth of hips, total posterior length of the arm, and the vertical girth of the trunk, age being included as a further check.

These 8 measurements were divided into every possible combination of 2, and regression equations and multiple correlations were calculated for each of the 20 items on each of the combinations. In general, the regression equation is a formula which gives the predicted value of one measurement from the known values of a combination of others. The multiple correlation coefficient, like the simple correlation coefficients given in tables 2 and 3, is an index which measures how closely a measurement can be predicted from any given combination of other measurements.

This study has brought out several important facts. It showed, for instance, that if the measurements are divided into two categories, namely, lengths and girths, then in predicting a length, another length is the most important factor, while in predicting a girth, another girth is most important. Tables 5 and 6 illustrate this point well. Columns 2, 3, 7, and 8 of table 5 give the coefficient of the regression equation of 17 measurements on stature and girth of hips, and

columns 4, 5, 9, and 10 give the percentage each coefficient is of the sum of both coefficients. These coefficients in standard units express the relative importance of a particular measurement in predicting the other measurements.

Thus, in predicting arm length on the basis of stature and girth of hips (table 5), in the case of the boys, stature contributes 92.6 percent, while girth of hips contributes only 7.4 percent. On the other hand, in predicting girth of chest,

stature contributes only 22.5 percent, while girth of hips contributes 77.5 percent. It is also interesting to note that in predicting weight, the girth of hips contributes much more than stature.

The same is true in table 6, where the girth of chest was included in the regression equation for the prediction of the other measurements. This, together with a more extensive analysis, shows that the best predictor of both girths and lengths is a girth (or weight) in combination with a length.

TABLE 5.—Standard coefficients of regression, with corresponding percentage contribution and multiple correlation, of 17 measurements on stature and hip girth

Measurements	Boys					Girls				
	Standard coefficient of—		Percentage contribution of—		Multiple correlation	Standard coefficient of—		Percentage contribution of—		Multiple correlation
	Stature	Hip girth	Stature	Hip girth		Stature	Hip girth	Stature	Hip girth	
Waist height.....	0.9885	0.0021	99.8	0.2	0.990	0.9835	0.0075	99.2	0.8	0.990
Hip height.....	1.0335	-.0539	95.0	5.0	.985	1.0522	-.0781	93.1	6.9	.982
Weight.....	.2495	.7490	25.0	75.0	.980	.1502	.8474	15.1	84.9	.985
Cervicale height.....	.9803	.0175	98.3	1.7	.996	.9714	.0274	97.3	2.7	.996
Tibiale height.....	.9812	-.0101	99.0	1.0	.972	.9998	-.0355	96.6	3.4	.968
Bitrochanteric diameter.....	.2098	.7830	21.1	78.9	.977	.1689	.8265	17.0	83.0	.982
Chest girth.....	.2175	.7497	22.5	77.5	.951	.1179	.8464	12.2	87.8	.954
Waist girth.....	-.2185	1.1065	16.5	83.5	.914	-.3009	1.1578	20.6	79.4	.896
Neck-base girth.....	.3928	.5132	43.4	56.6	.884	.3388	.5694	37.3	62.7	.887
Armscye girth.....	.3218	.6408	33.4	66.6	.942	.2215	.7315	23.2	76.8	.936
Upper-arm girth.....	-.3176	1.2091	20.8	79.2	.932	-.3819	1.2572	23.3	76.7	.927
Posterior-arm length.....	.9075	.0728	92.6	7.4	.974	.9106	.0700	92.9	7.1	.974
Thigh girth.....	-.2395	1.1803	16.9	83.1	.969	-.2295	1.1741	16.4	83.6	.972
Maximum calf girth.....	.1024	.8543	10.7	89.3	.948	.0516	.8978	5.4	94.6	.945
Knee girth.....	.2572	.7188	26.4	73.6	.958	.1944	.7739	20.1	79.9	.953
Crotch length.....	.3387	.6235	35.2	64.8	.941	.2634	.6996	27.4	72.6	.944
Vertical trunk girth.....	.5329	.4619	53.6	46.4	.971	.4975	.5033	49.7	50.3	.976

TABLE 6.—Standard coefficients of regression, with corresponding percentage contribution and multiple correlation, of 16 measurements on stature, chest girth, and hip girth

Measurements	Boys							Girls						
	Standard coefficient of—			Percentage contribution of—			Multiple correlation	Standard coefficient of—			Percentage contribution of—			Multiple correlation
	Stature	Chest girth	Hip girth	Stature	Chest girth	Hip girth		Stature	Chest girth	Hip girth	Stature	Chest girth	Hip girth	
Waist height.....	0.9925	-0.0183	0.0158	96.7	1.8	1.5	0.990	0.9819	.0131	-0.0037	98.3	1.3	0.4	0.990
Hip height.....	1.0315	.0093	-.0608	93.7	.8	5.5	.985	1.0478	0.0375	-.1099	87.7	3.1	9.2	.983
Weight.....	.1907	.2701	.5466	18.9	26.8	54.3	.984	.1219	.2409	.6436	12.1	23.9	64.0	.988
Cervicale height.....	.9800	.0014	.0164	98.2	.2	1.6	.996	.9712	.0018	.0258	97.2	.2	2.6	.996
Tibiale height.....	.9786	.0119	-.0190	96.9	1.2	1.9	.972	.9966	.0266	-.0580	92.2	2.5	5.3	.968
Bitrochanteric diameter.....	.2057	.0189	.7688	20.7	1.9	77.4	.977	.1686	.0025	.8244	16.9	.2	82.9	.982
Waist girth.....	-.3277	.5020	.7302	21.0	32.2	46.8	.927	-.3758	.6362	.6194	23.0	39.0	38.0	.916
Neck-base girth.....	.2901	.4309	.1902	32.5	46.8	20.7	.894	.2989	.3381	.2833	32.5	36.7	30.8	.893
Armscye girth.....	.2418	.3679	.3650	24.8	37.7	37.5	.949	.1755	.3905	.4019	18.1	40.4	41.5	.944
Upper-arm girth.....	-.4052	.4028	.9072	23.6	23.5	52.9	.940	-.4293	.4021	.9169	24.5	23.0	52.5	.935
Posterior-arm length.....	.8856	.1006	-.0027	89.6	10.1	.3	.974	.9000	.0903	-.0064	90.3	9.1	.6	.975
Thigh girth.....	-.2585	.0875	1.1147	17.7	6.0	76.3	.970	-.2458	.1382	1.0571	17.1	9.6	73.3	.973
Maximum calf girth.....	.0636	.1783	.7206	6.6	18.5	74.9	.950	.0316	.1694	.7545	3.3	17.7	79.0	.946
Knee girth.....	.2398	.0800	.6589	24.5	8.2	67.3	.958	.1823	.1031	.6867	18.8	10.6	70.6	.954
Crotch length.....	.3281	.0486	.5870	34.0	5.0	61.0	.941	.2582	.0442	.6621	26.8	4.6	68.6	.944
Vertical trunk girth.....	.4942	.1782	.3283	49.4	17.8	32.8	.973	.4842	.1121	.4084	48.2	11.2	40.6	.977

## Height and Hip Measure Recommended as Basis for Sizes

Once the fact has been established that a length and a girth (or weight) are needed as a basis for sizing garments, the problem of which length to choose is not hard to solve from both a practical and statistical point of view. A study of the multiple correlations shows that of all the possible combinations of girths (or weight) with lengths, the best combinations are waist height (from the floor) and a girth (or weight); or stature and a girth (or weight). Since waist height has a smaller range of measurement than stature and since it is more difficult to take on a child, it would seem preferable to use stature.

When a child's height is known, his other lengths can be predicted fairly accurately. For example, if a boy's stature is known, his hip height, waist height, arm length, and other lengths can be predicted with a variation of less than 1 inch on an average. The same holds true for girls. This, of course, is not surprising since some of these lengths form major parts of height.

However, the problem of which measurement to choose in order to predict the girths is slightly more complicated. The statistical analysis shows that the best predictor of all girths and lengths is either a combination of height and weight, or height and hip circumference. A poorer, but possible, combination is height and chest girth.

TABLE 7.—Multiple correlations and percentage reduction variations of the measurements to be predicted, obtained on the basis of (1) stature and weight combination, (2) stature and hip girth combination, (3) stature and chest girth combination

Measurements to be predicted	Boys						Girls					
	Stature—weight		Stature—hip girth		Stature—chest girth		Stature—weight		Stature—hip girth		Stature—chest girth	
	Multiple correlation	Percentage reduction	Multiple correlation	Percentage reduction	Multiple correlation	Percentage reduction	Multiple correlation	Percentage reduction	Multiple correlation	Percentage reduction	Multiple correlation	Percentage reduction
Waist height.....	0.990	98.1	0.990	98.1	0.991	98.1	0.990	98.0	0.990	98.1	0.990	98.1
Hip height.....	.985	97.0	.985	97.0	.985	97.0	.982	96.5	.982	96.5	.982	96.4
Weight.....			.980	96.1	.971	94.2			.985	97.0	.972	94.5
Stature.....												
Cervicale height.....	.996	99.2	.996	99.2	.996	99.3	.996	99.2	.996	99.2	.996	99.2
Tibiale height.....	.972	94.5	.972	94.5	.972	94.5	.968	93.6	.968	93.7	.968	93.7
Bitrochanteric diameter.....	.964	92.9	.977	95.4	.950	90.2	.970	94.0	.982	96.4	.955	91.3
Chest girth.....	.958	91.8	.951	90.4			.961	92.4	.954	91.0		
Waist girth.....	.915	83.7	.914	83.5	.901	81.2	.905	82.0	.896	80.2	.900	81.0
Hip girth.....	.974	94.9			.955	91.2	.983	96.6			.962	92.5
Neck-base girth.....	.893	79.7	.884	78.2	.893	79.7	.894	79.9	.887	78.7	.890	79.1
Armseye girth.....	.946	89.4	.942	88.7	.943	88.8	.940	88.4	.936	87.7	.937	87.8
Upper-arm girth.....	.930	86.5	.932	86.8	.901	81.1	.931	86.6	.927	86.0	.901	81.2
Posterior arm length.....	.974	94.8	.974	94.8	.974	94.9	.974	94.9	.974	94.9	.975	95.0
Thigh girth.....	.943	88.9	.969	93.9	.911	83.1	.961	92.3	.972	94.5	.929	86.3
Maximum calf girth.....	.948	89.9	.948	89.8	.925	85.6	.948	89.8	.945	89.2	.923	85.2
Knee girth.....	.950	90.3	.958	91.7	.938	88.0	.950	90.3	.953	90.8	.935	87.4
Crotch length.....	.938	88.0	.941	88.5	.925	85.5	.941	88.5	.944	89.1	.927	85.9
Vertical trunk girth.....	.974	94.9	.971	94.3	.968	93.6	.977	95.4	.976	95.3	.970	94.1

Table 7 gives the multiple correlations and the percentage reduction in the variations of the measurements to be predicted from the combinations of (1) stature and weight, (2) stature and girth of hips, and (3) stature and chest. The larger the multiple correlation the greater will be the percentage reduction in the variations of the measurements to be predicted. By comparing column 2 with column 4 and column 3 with

5, it will be seen that the multiple correlations and percentage reductions obtained on the combination of stature and weight of the boys do not on the whole differ from those obtained on the combination of stature and girth of hips. Thus, for the purpose of predicting the other measurements, stature and weight in combination is as effective as stature and girth of hips. On the other hand, by comparing column 4 with column



6. and column 5 with column 7. it will be noticed that the multiple correlations and percentage reduction obtained on the combination of stature and girth of hips are on the whole larger than those obtained on the combination of stature and girth of chest. Similar relationships will be observed between comparable columns relating to the girls' measurements.

Weight has been rejected for the very practical reason that every family does not possess a scale but usually has a tape measure. Hip girth has been chosen in preference to chest girth not only because of the results shown in table 7 but also for the following reasons:

A study on several thousand duplicate measurements taken by the measurers in the field shows that hip girth can be measured much more accurately than chest girth.

A study based on partial correlations (stature being held constant) has also shown that girth of hips explains the variations of the other girths better than does chest girth. This may be because girth of hips is more closely related to the fleshy and fatty parts of the body than chest girth.

The possibility of sizing garments on the basis of 3 measurements was also considered in this study even though it was realized that such a scheme would be very complicated. An analysis was undertaken to determine whether including a third measurement in the combination of 2 would yield sufficient information to warrant the sizing of garments on the basis of three measurements. This was done by setting up regression equations and calculating multiple correlations of every one of the 20 items on combination of 3 of these items.

This analysis showed that introducing a third measurement into a combination of two does not increase the multiple correlation

**Third dimension unnecessary** to any appreciable extent. For instance, columns 8 and 15 of table 6 give the multiple correlations on combinations of stature, chest girth, and hip girth. By comparing these columns with columns 4 and 10 of table 7, it will be noticed that the multiple correlations for corresponding measurements either remain the same when chest girth is included in the combination or are increased by a small amount. The slight increase occurs chiefly when an upper girth is predicted.

A combination of stature and hip measure is therefore recommended as a basis for sizes of patterns and garments. It should be noticed that the system suggested based on this combination refers to basic body measurements, taken next to the skin, and not to garment and patterns in which allowances must be made for undergarments.

### *Proposed Standard System Based on Height and Hip Measure*

A system of sizes was obtained by marking off intervals of height and of hip measure on a distribution table giving the number of children having different combinations of height (stature) and hip girth. (See figs. 1 and 2 in pocket on back of cover.) The small figures on these charts represent the number of children who had a stature equal to the number of centimeters shown on the horizontal scale and a hip measure equal to the number of centimeters shown on the vertical scale.

For example, of the 835 boys who had a height of 120 centimeters, it will be found by locating the figure 120 on the horizontal scale and following it up vertically, that though they all had the same height, 1 boy had a hip measure of 50 centimeters; 1, a hip measure of 51 centimeters; 4, a hip measure of 55 centimeters; 16, a hip measure of 56 centimeters; 30, a hip measure of 57 centimeters, and so on. (Approximately  $2\frac{1}{2}$  centimeters is equal to 1 inch; more exactly, 1 centimeter equals 0.3937 inch.) Similarly, the distribution of the heights of the 1,889 boys who had a hip measure of 60 centimeters can be obtained by locating the figure 60 on the vertical scale and following the line across. It will be found that although all these boys measured the same around their hips, 1 had a height of 101 centimeters; 2, a height of 103 centimeters; 1, a height of 104 centimeters; and 6, a height of 106 centimeters, and so forth.

Fifty-two height-hip intervals for boys and 49 for girls were drawn on these charts in the form of rectangles. The size of these rectangles and their position are given in figures 3 and 4. They are drawn both to inch and to centimeter scale. With few exceptions almost every child can be located in the proper rectangle by reading his height on the horizontal scale and his hip measure on the vertical scale. The rectangle in which he is thus placed determines the size he takes. A size consists of averages for each of 36 body measurements. These averages were calculated on the basis of the total number of children in a given rectangle, i. e., a height-hip interval.

Thirty-nine of these height-hip intervals for boys and 36 for girls are proposed as a standard system of sizing (tables 8 and 9). These represent 89.1 percent and 86.0 percent of the samples of boys and girls, respectively. Since the remaining intervals apply to such a small percentage of children, it would not be commercially practicable to include them in a standard, and tables for them are not given here. However, they will be of assistance to those manufacturers who have a demand for garments for children whose circumferences in relation to their height are much larger or much smaller than those of the majority of children.

The rectangles were so chosen that the middle one for a given height interval contains the greatest number of cases. These central rectangles constitute the

**Regulars and auxiliary sizes**

basis for the regular or group "C" sizes in the proposed standard. The rectangles below the middle ones constitute the basis for "below regular" or "B" sizes since the children represented in these rectangles though located in the same height interval have smaller hip circumferences than those in the middle rectangles. The rectangles lying above the middle ones constitute the basis for the "above regular" or "D" sizes. For the same height interval, the children in these rectangles have bigger hips than those in the regular rectangles.

The regular sizes suggested include 49.8 percent of the total number of boys measured and 41.8 percent of the total number of girls. The "below regular" sizes include 17.8 percent and 22.5 percent of the boys and girls, respectively, and the "above regular" sizes 21.5 percent and 21.7 percent, respectively.

Figures 3 and 4 not only give the size of the intervals but also the approximate height (in inches) and the approximate hip measure (in inches) for each interval. They also show the percentage of children in each rectangle, calculated on the basis of the total number of children in that height interval. The measurements are given in a fraction of an inch. These may be rounded off by the manufacturers when the factor of allowance is taken into consideration.

It will be noticed that for a given height interval the change in the length measurements from one size to another is very slight. This is as expected since it has been shown that, given a child's height, his lengths are fairly well determined. A change in hip measure does not substantially affect the lengths.

Some of the lengths, notably height of hips and height of waist, instead of increasing as one proceeds from one size to another, in the same height interval, tend slightly to decrease. This only bears out the analysis which shows that for a constant height the correlation of hip height or waist height with hip girth is small and negative.

TABLE S.—Proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1, C_1, D_1$ , show corresponding intervals on fig. 3) and designated by approximate height and hip dimensions in inches

Item No. and measurement	$B_1$	$C_1$	$D_1$
	Height, 40½; hip, 20	Height, 40½; hip, 21½	Height, 40½; hip, 23
1. Waist height..... inches	23¾	24	24½
2. Hip height..... do	19	19½	19
3. Weight..... pounds	33½	36½	39½
4. Stature..... inches	40¾	40¾	40¾
5. Cervicale height..... do	32¾	33¾	33¾
6. Tibiale height..... do	10¾	10¾	10¾
7. Crotch height..... do	17¾	16¾	16¾
8. Bitrochanteric diameter..... do	7¼	7¾	7¾
9. Shoulder slope..... degrees	25¼	26	25½
10. Anterior chest width..... inches	7½	7¾	8
11. Anterior waist length..... do	8½	8¾	8¾
12. Posterior chest width..... do	9	9¾	9¾
13. Posterior waist length..... do	9¾	9¾	9¾
14. Chest girth at armscye..... do	21¼	21¾	22½
15. Seye depth..... do	4¾	4¾	4¾
16. Posterior hip arc..... do	9¾	10¾	11½
17. Maximum chest girth..... do			
18. Anterior chest arc..... do	11	11¾	11¾
19. Waist girth..... do	19½	19¾	20
20. Hip girth..... do	20¼	21¾	22¾
21. Neck-base girth..... do	10¾	10¾	11
22. Shoulder length..... do	25¾	25¾	25¾
23. Armscye girth..... do	9¾	9¾	10¾
24. Upper-arm girth..... do	6	6¾	6¾
25. Elbow girth..... do	6¾	7	7¼
26. Upper posterior arm length..... do	7¾	8	8
27. Total posterior arm length..... do	13¾	14¾	14¾
28. Trunk line..... do	4¾	4¾	4¾
29. Waist to hips..... do	5	5¾	5¾
30. Thigh girth..... do	11¾	12¾	13½
31. Maximum calf girth..... do	7¾	8¾	8¾
32. Knee girth..... do	8½	8¾	9¼
33. Total crotch length..... do	16¾	17¾	18
34. Anterior crotch length..... do	8½	8¾	9
35. Extreme bend..... do	16½	17	17¼
36. Vertical trunk girth..... do	36¾	37¾	38
37. Percentage <sup>1</sup> ..... percent	17	61	21

Item No. and measurement	$B_3$	$C_3$	$D_3$
	Height, 45; hip, 22	Height, 45; hip, 23	Height, 45½; hip, 24½
1. Waist height..... inches	28	27¾	27¼
2. Hip height..... do	21¾	21¾	21¾
3. Weight..... pounds	41	44	48
4. Stature..... inches	44¾	45¾	45¾
5. Cervicale height..... do	37¾	37¾	37½
6. Tibiale height..... do	12	12	12
7. Crotch height..... do	19¾	19¾	19½
8. Bitrochanteric diameter..... do	7¾	8¼	8½
9. Shoulder slope..... degrees	25½	26	26
10. Anterior chest width..... inches	8¼	8¼	8¼
11. Anterior waist length..... do	9¼	9¾	9¾
12. Posterior chest width..... do	9¾	9¾	10½
13. Posterior waist length..... do	10¼	10¼	10¾
14. Chest girth at armscye..... do	22½	23¼	23¾
15. Seye depth..... do	4¾	5	5½
16. Posterior hip arc..... do	10¾	11¼	12
17. Maximum chest girth..... do			
18. Anterior chest arc..... do	11½	12¼	12¼
19. Waist girth..... do	20	20¾	21¾
20. Hip girth..... do	21¾	23¾	24¾
21. Neck-base girth..... do	11¾	11¾	11¾
22. Shoulder length..... do	27	3	3
23. Armscye girth..... do	10¼	10¾	11
24. Upper-arm girth..... do	6¼	6¾	7
25. Elbow girth..... do	7¼	7¾	7¾
26. Upper posterior arm length..... do	8¾	8¾	9
27. Total posterior arm length..... do	15¾	15¾	16
28. Trunk line..... do	5¾	5¾	5¾
29. Waist to hips..... do	5½	5¾	5¾
30. Thigh girth..... do	12¾	13	13¾
31. Maximum calf girth..... do	8¾	9	9¾
32. Knee girth..... do	9¼	9¾	9¾
33. Total crotch length..... do	18¼	18¾	19¾
34. Anterior crotch length..... do	9¼	9¾	9¾
35. Extreme bend..... do	18¾	18¾	19¾
36. Vertical trunk girth..... do	39¼	40¼	41
37. Percentage <sup>1</sup> ..... percent	14	60	23

Item No. and measurement	$B_2$	$C_2$	$D_2$
	Height, 42½; hip, 21	Height, 43; hip, 22	Height, 43; hip, 23½
1. Waist height..... inches	25¾	25¾	25¾
2. Hip height..... do	20½	20½	20½
3. Weight..... pounds	37	40	44
4. Stature..... inches	42¾	42¾	43¾
5. Cervicale height..... do	35	35¼	35¼
6. Tibiale height..... do	11½	11¼	11¼
7. Crotch height..... do	18¾	18¼	18¼
8. Bitrochanteric diameter..... do	7¼	7¾	8¼
9. Shoulder slope..... degrees	24¾	25½	26
10. Anterior chest width..... inches	7¾	8	8¼
11. Anterior waist length..... do	8¾	9	9¾
12. Posterior chest width..... do	9¼	9¼	9¾
13. Posterior waist length..... do	9¾	9¾	10
14. Chest girth at armscye..... do	21¾	22¼	23¼
15. Seye depth..... do	4¾	4¾	4¾
16. Posterior hip arc..... do	10¼	10¾	11½
17. Maximum chest girth..... do			
18. Anterior chest arc..... do	11¾	12¾	12¾
19. Waist girth..... do	19½	20¾	21¼
20. Hip girth..... do	21	22¼	23¾
21. Neck-base girth..... do	10¾	11¼	11¾
22. Shoulder length..... do	28¼	28	28
23. Armscye girth..... do	9¾	10¼	10¾
24. Upper-arm girth..... do	6¼	6¾	6¾
25. Elbow girth..... do	7¾	7¼	7¼
26. Upper posterior arm length..... do	8¾	8¾	8¾
27. Total posterior arm length..... do	14¾	15	15¾
28. Trunk line..... do	5¼	5¼	5¼
29. Waist to hips..... do	5¼	5¾	5¾
30. Thigh girth..... do	11¾	12¾	13¾
31. Maximum calf girth..... do	8¼	8¾	9¼
32. Knee girth..... do	8¾	9¼	9¾
33. Total crotch length..... do	17¾	18	18¾
34. Anterior crotch length..... do	8¾	9¼	9¾
35. Extreme bend..... do	17¾	17¾	18¼
36. Vertical trunk girth..... do	37¾	38¼	39½
37. Percentage <sup>1</sup> ..... percent	17	60	21

Item No. and measurement	$B_4$	$C_4$	$D_4$
	Height, 47; hip, 22½	Height, 47½; hip, 24	Height, 48; hip, 25
1. Waist height..... inches	28¾	29	29¼
2. Hip height..... do	23¾	23¾	23¾
3. Weight..... pounds	45	49	53
4. Stature..... inches	47¾	47¾	47¾
5. Cervicale height..... do	39	39¾	39¾
6. Tibiale height..... do	12¾	12¾	12¾
7. Crotch height..... do	20¾	21	20¾
8. Bitrochanteric diameter..... do	8¼	8¼	8¾
9. Shoulder slope..... degrees	25½	25½	25½
10. Anterior chest width..... inches	8¾	8¾	8¾
11. Anterior waist length..... do	9¾	9¾	9¾
12. Posterior chest width..... do	10	10¼	10¾
13. Posterior waist length..... do	10¾	10¾	10¾
14. Chest girth at armscye..... do	23½	24	24¾
15. Seye depth..... do	5¾	5¼	5¼
16. Posterior hip arc..... do	11	11¾	12¾
17. Maximum chest girth..... do			
18. Anterior chest arc..... do	12	12¼	13
19. Waist girth..... do	20¾	21¾	21¾
20. Hip girth..... do	22½	23¾	25¾
21. Neck-base girth..... do	11¾	11¾	11¾
22. Shoulder length..... do	31	31	31
23. Armscye girth..... do	10¾	11	11¾
24. Upper-arm girth..... do	6¾	6¾	7¼
25. Elbow girth..... do	7¾	7¾	8
26. Upper posterior arm length..... do	9¾	9¾	9¾
27. Total posterior arm length..... do	16½	16¾	17½
28. Trunk line..... do	5¾	5¾	5¾
29. Waist to hips..... do	5¾	5¾	5¾
30. Thigh girth..... do	12¾	13¼	14¾
31. Maximum calf girth..... do	9¼	9¼	9¾
32. Knee girth..... do	9¾	9¾	10¼
33. Total crotch length..... do	18¾	19¼	20¾
34. Anterior crotch length..... do	9¾	9¾	10¾
35. Extreme bend..... do	19¼	19¾	20
36. Vertical trunk girth..... do	40¾	41¾	42½
37. Percentage <sup>1</sup> ..... percent	12	57	27

See footnotes at end of table.

TABLE 8.—Proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1$ ,  $C_1$ ,  $D_1$ , show corresponding intervals on fig. 3) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$B_5$	$C_5$	$D_5$	Item No. and measurement	$B_7$	$C_7$	$D_7$
	Height, 49½; hip, 24	Height, 50; hip, 25	Height, 50; hip, 26½		Height, 54; hip, 25½	Height, 54½; hip, 27	Height, 55; hip, 29
1. Waist height.....inches	30¼	30¾	30¾	1. Waist height.....inches	34	34¼	34½
2. Hip height.....do	24½	24¾	24¾	2. Hip height.....do	27½	27¾	27¾
3. Weight.....pounds	50½	55	60	3. Weight.....pounds	62	68	75
4. Stature.....inches	49½	49¾	50	4. Stature.....inches	54¼	54½	54¾
5. Cervicale height.....do	41½	41¾	41¾	5. Cervicale height.....do	45¼	45½	45¾
6. Tibiale height.....do	13¾	13¾	13¾	6. Tibiale height.....do	15	15	15½
7. Crotch height.....do	22¾	22¾	22¾	7. Crotch height.....do	25½	25½	25
8. Bitrochanteric diameter.....do	8¾	8¾	9¼	8. Bitrochanteric diameter.....do	9¼	9½	10½
9. Shoulder slope.....degrees	25½	25½	25½	9. Shoulder slope.....degrees	25	25	25
10. Anterior chest width.....inches	9¾	9¾	9¾	10. Anterior chest width.....inches	9½	9¾	10½
11. Anterior waist length.....do	10	10¼	10¼	11. Anterior waist length.....do	10½	10¾	11
12. Posterior chest width.....do	10¾	10¾	10¾	12. Posterior chest width.....do	11	11½	11½
13. Posterior waist length.....do	11	11¼	11¼	13. Posterior waist length.....do	11¾	12	12
14. Chest girth at armseye.....do	24½	24¾	25¼	14. Chest girth at armseye.....do	25¾	26¾	27½
15. Scye depth.....do	5¾	5¾	5½	15. Scye depth.....do	5¾	5¾	6
16. Posterior hip arc.....do	11½	12½	13	16. Posterior hip arc.....do	12½	13¼	14¼
17. Maximum chest girth.....do	24¼	25½	26	17. Maximum chest girth.....do	26	27	28
18. Anterior chest arc.....do	12¾	13	13¼	18. Anterior chest arc.....do	13¼	14¾	14¾
19. Waist girth.....do	21	21¾	22½	19. Waist girth.....do	22	23½	23½
20. Hip girth.....do	23¼	23	25½	20. Hip girth.....do	25½	27¼	28½
21. Neck-base girth.....do	11¾	12	12¼	21. Neck-base girth.....do	12¾	12¾	12¾
22. Shoulder length.....do	3¼	3¼	3¾	22. Shoulder length.....do	3¾	3¾	3¾
23. Armseye girth.....do	11¾	11¾	11¾	23. Armseye girth.....do	12½	12½	13
24. Upper-arm girth.....do	6¾	7	7½	24. Upper-arm girth.....do	7½	7½	8¼
25. Elbow girth.....do	7¾	8	8¾	25. Elbow girth.....do	8	8¾	9
26. Upper posterior arm length.....do	9¼	10	10½	26. Upper posterior arm length.....do	10¾	11¼	11¼
27. Total posterior arm length.....do	17¾	17¾	17¾	27. Total posterior arm length.....do	19¾	19¾	19¾
28. Trunk line.....do	6	6½	5¾	28. Trunk line.....do	6¼	6¼	6¼
29. Waist to hips.....do	13½	14½	15¼	29. Waist to hips.....do	6½	6½	6¾
30. Thigh girth.....do	14½	15½	15½	30. Thigh girth.....do	14¾	15½	16¾
31. Maximum calf girth.....do	10	10¾	10¾	31. Maximum calf girth.....do	10	10½	11½
32. Knee girth.....do	10	10¾	10¾	32. Knee girth.....do	10¾	11¼	11¼
33. Total crotch length.....do	19¾	20¾	21	33. Total crotch length.....do	21½	22	22½
34. Anterior crotch length.....do	10	10¼	10¾	34. Anterior crotch length.....do	10¾	11½	11½
35. Extreme bend.....do	20¾	20¾	21½	35. Extreme bend.....do	22¾	22¾	23¼
36. Vertical trunk girth.....do	42¾	43¼	44¼	36. Vertical trunk girth.....do	45¾	46¾	47¼
37. Percentage <sup>1</sup> .....percent	17	54	23	37. Percentage <sup>1</sup> .....percent	14	57	23

Item No. and measurement	$B_6$	$C_6$	$D_6$	Item No. and measurement	$B_8$	$C_8$	$D_8$
	Height, 52; hip, 24½	Height, 52; hip, 26	Height, 52½; hip, 27½		Height, 56½; hip, 27	Height, 57; hip, 28½	Height, 57; hip, 30
1. Waist height.....inches	32¼	32½	32¾	1. Waist height.....inches	35¾	36	36½
2. Hip height.....do	26½	26¼	26¾	2. Hip height.....do	29¼	29¾	29¾
3. Weight.....pounds	55½	61	67½	3. Weight.....pounds	69	75½	84
4. Stature.....inches	51¾	52½	52¾	4. Stature.....inches	56¾	56¾	57
5. Cervicale height.....do	43¼	43¾	43¾	5. Cervicale height.....do	47¾	48	48¼
6. Tibiale height.....do	14½	14¼	14¾	6. Tibiale height.....do	15¾	15¾	15¾
7. Crotch height.....do	23¾	23¾	23¾	7. Crotch height.....do	26½	26½	26¾
8. Bitrochanteric diameter.....do	8¾	9¼	9¾	8. Bitrochanteric diameter.....do	9¾	10½	10¾
9. Shoulder slope.....degrees	25	25	25	9. Shoulder slope.....degrees	25	25	25
10. Anterior chest width.....inches	9¾	9¾	9¾	10. Anterior chest width.....inches	9¾	10½	10½
11. Anterior waist length.....do	10¼	10¼	10¾	11. Anterior waist length.....do	11	11½	11¼
12. Posterior chest width.....do	10¾	11	11¼	12. Posterior chest width.....do	11¾	11¾	11¾
13. Posterior waist length.....do	11½	11½	11¾	13. Posterior waist length.....do	12¼	12¾	12½
14. Chest girth at armseye.....do	24½	25½	26¾	14. Chest girth at armseye.....do	26¾	27¾	28½
15. Scye depth.....do	5¾	5¾	5¾	15. Scye depth.....do	6	6½	6¼
16. Posterior hip arc.....do	11¾	12¾	13¾	16. Posterior hip arc.....do	13	13¾	14¾
17. Maximum chest girth.....do	25	26	27	17. Maximum chest girth.....do	26¾	27¾	29
18. Anterior chest arc.....do	13	13½	14½	18. Anterior chest arc.....do	14½	14¾	15¾
19. Waist girth.....do	21½	22¼	23¼	19. Waist girth.....do	22¾	23¼	24¾
20. Hip girth.....do	24½	26	27½	20. Hip girth.....do	26¾	28¾	30½
21. Neck-base girth.....do	12	12¼	12½	21. Neck-base girth.....do	12¾	13	13¼
22. Shoulder length.....do	3¾	3½	3½	22. Shoulder length.....do	3¾	3¾	3¾
23. Armseye girth.....do	11½	12	12½	23. Armseye girth.....do	12¾	13½	13¾
24. Upper-arm girth.....do	6¾	7¼	7¾	24. Upper-arm girth.....do	7¾	7¾	8½
25. Elbow girth.....do	8	8¾	8¾	25. Elbow girth.....do	8¾	9	9¾
26. Upper posterior arm length.....do	10¾	10½	10¾	26. Upper posterior arm length.....do	11½	11½	11¾
27. Total posterior arm length.....do	18¾	18¾	18¾	27. Total posterior arm length.....do	20¾	20¾	20¾
28. Trunk line.....do	6	6½	6	28. Trunk line.....do	6½	6½	6½
29. Waist to hips.....do	13½	14½	15¼	29. Waist to hips.....do	6¼	6¾	6¾
30. Thigh girth.....do	13¾	14¾	16	30. Thigh girth.....do	15	16½	17¾
31. Maximum calf girth.....do	10½	10¾	10¾	31. Maximum calf girth.....do	10¾	11	11½
32. Knee girth.....do	10¾	10¾	11¼	32. Knee girth.....do	11¼	11¼	12¼
33. Total crotch length.....do	20¾	21¾	21¾	33. Total crotch length.....do	22¼	22¾	23¾
34. Anterior crotch length.....do	10¾	10¾	11	34. Anterior crotch length.....do	11¼	11½	12
35. Extreme bend.....do	21¾	21¾	22¼	35. Extreme bend.....do	23¾	23¾	24¾
36. Vertical trunk girth.....do	43¾	44¾	46	36. Vertical trunk girth.....do	47¼	48¾	49¾
37. Percentage <sup>1</sup> .....percent	13	60	23	37. Percentage <sup>1</sup> .....percent	15	52	24

See footnotes at end of table.

TABLE 8.—Proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1$ ,  $C_1$ ,  $D_1$ , show corresponding intervals on fig. 3) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$B_9$	$C_9$	$D_9$
	Height, 59; hip, 28	Height, 59; hip, 30	Height, 59½; hip, 32
1. Waist height..... inches	37½	37¼	37½
2. Hip height..... do	30¾	30¾	30¾
3. Weight..... pounds	78	86	95½
4. Stature..... inches	59	59¼	59¾
5. Cervicale height..... do	50	50¼	50¾
6. Tibiale height..... do	16½	16¾	16¾
7. Crotch height..... do	27½	27¾	27¾
8. Bitrochanteric diameter..... do	10½	10¾	11½
9. Shoulder slope..... degrees	24½	24½	25
10. Anterior chest width..... inches	10½	10¾	11
11. Anterior waist length..... do	11½	11½	11½
12. Posterior chest width..... do	11¾	12½	12¾
13. Posterior waist length..... do	12¾	12¾	13
14. Chest girth at armseye..... do	28	29½	30¾
15. Scye depth..... do	6¼	6¾	6¾
16. Posterior hip arc..... do	13½	14½	15½
17. Maximum chest girth..... do	28	29½	30¾
18. Anterior chest arc..... do	14¾	15¾	16½
19. Waist girth..... do	23½	24¾	25¾
20. Hip girth..... do	28¾	29¾	31¾
21. Neck-base girth..... do	13	13¾	13¾
22. Shoulder length..... do	3¾	3¾	4
23. Armseye girth..... do	13¼	13¾	14¾
24. Upper-arm girth..... do	7¾	8¾	9
25. Elbow girth..... do	9½	9½	9¾
26. Upper posterior arm length..... do	12½	12¾	12¾
27. Total posterior arm length..... do	21¾	21¾	21¾
28. Trunk line..... do	6¾	6¾	6¾
29. Waist to hips..... do	7	7½	7½
30. Thigh girth..... do	15¾	17½	18½
31. Maximum calf girth..... do	11	11½	12¼
32. Knee girth..... do	11½	12¾	12¾
33. Total crotch length..... do	23¼	24¾	25½
34. Anterior crotch length..... do	11½	12¼	12¾
35. Extreme bend..... do	24¾	25	25½
36. Vertical trunk girth..... do	49¼	50¾	52
37. Percentage <sup>1</sup> ..... percent	23	47	21

Item No. and measurement	$B_{11}$	$C_{11}$	$D_{11}$
	Height, 64; hip, 31½	Height, 64; hip, 33	Height, 64; hip, 35
1. Waist height..... inches	40¾	40¾	40¾
2. Hip height..... do	33¼	33¾	33¾
3. Weight..... pounds	100½	111	123
4. Stature..... inches	63¼	64	64¼
5. Cervicale height..... do	54½	54¾	54¾
6. Tibiale height..... do	18¼	18	17¾
7. Crotch height..... do	30¾	30	29¾
8. Bitrochanteric diameter..... do	11¼	11½	12¾
9. Shoulder slope..... degrees	24	25	25½
10. Anterior chest width..... inches	11½	11½	12½
11. Anterior waist length..... do	12¾	12¾	12¾
12. Posterior chest width..... do	12¾	13¼	13¾
13. Posterior waist length..... do	14	14¼	14¾
14. Chest girth at armseye..... do	30¾	32¾	33¾
15. Scye depth..... do	6¾	7	7¼
16. Posterior hip arc..... do	15½	16	17
17. Maximum chest girth..... do	30¾	32¼	33¾
18. Anterior chest arc..... do	16¼	17	17¾
19. Waist girth..... do	25½	26¼	27½
20. Hip girth..... do	31¾	33	34¾
21. Neck-base girth..... do	14½	14¾	15½
22. Shoulder length..... do	4¼	4¾	4¾
23. Armseye girth..... do	14¾	15¾	16
24. Upper-arm girth..... do	8¾	8¾	10½
25. Elbow girth..... do	10½	10½	11
26. Upper posterior arm length..... do	13½	13¼	13¾
27. Total posterior arm length..... do	23¾	23½	23¾
28. Trunk line..... do	7¾	7½	7½
29. Waist to hips..... do	7½	7¾	7¾
30. Thigh girth..... do	17½	18½	20¼
31. Maximum calf girth..... do	12½	12¾	13¼
32. Knee girth..... do	13	13¾	13¾
33. Total crotch length..... do	25½	26¾	27½
34. Anterior crotch length..... do	13¼	13¾	14¾
35. Extreme bend..... do	26¾	27½	27½
36. Vertical trunk girth..... do	54¾	56	57½
37. Percentage <sup>1</sup> ..... percent	25	42	22

Item No. and measurement	$B_{10}$	$C_{10}$	$D_{10}$
	Height, 61½; hip, 30	Height, 61½; hip, 31½	Height, 62; hip, 33
1. Waist height..... inches	39¾	39¾	39¾
2. Hip height..... do	32¼	32¼	32
3. Weight..... pounds	88	98	108
4. Stature..... inches	61¾	61¾	61¾
5. Cervicale height..... do	52¼	52½	52¾
6. Tibiale height..... do	17¾	17¾	17¾
7. Crotch height..... do	29¼	29	28¾
8. Bitrochanteric diameter..... do	10¾	11¼	11¾
9. Shoulder slope..... degrees	24½	25	25
10. Anterior chest width..... inches	10¾	11¼	11½
11. Anterior waist length..... do	11¾	12	12½
12. Posterior chest width..... do	12¼	12¾	12¾
13. Posterior waist length..... do	13¼	13¾	14¾
14. Chest girth at armseye..... do	29¾	30¾	31¾
15. Scye depth..... do	6½	6¾	6¾
16. Posterior hip arc..... do	14¾	15¼	16¼
17. Maximum chest girth..... do	29¼	30¾	31¾
18. Anterior chest arc..... do	15½	16¼	17
19. Waist girth..... do	24¾	25¾	26¾
20. Hip girth..... do	29¾	31½	33¼
21. Neck-base girth..... do	13½	14¼	14¾
22. Shoulder length..... do	4	4¾	4¾
23. Armseye girth..... do	14	14½	15½
24. Upper-arm girth..... do	8¼	8¾	9½
25. Elbow girth..... do	9¾	10	10¾
26. Upper posterior arm length..... do	12¾	12¾	12¾
27. Total posterior arm length..... do	22¾	22¾	22¾
28. Trunk line..... do	7	7	7
29. Waist to hips..... do	7¼	7¾	7½
30. Thigh girth..... do	16¾	18	19½
31. Maximum calf girth..... do	11½	12¼	12¾
32. Knee girth..... do	12½	13	13½
33. Total crotch length..... do	24¾	25¾	26¾
34. Anterior crotch length..... do	12½	13	13¾
35. Extreme bend..... do	25¾	26½	26½
36. Vertical trunk girth..... do	51½	53½	54¾
37. Percentage <sup>1</sup> ..... percent	26	43	20

Item No. and measurement	$B_{12}$	$C_{12}$	$D_{12}$
	Height, 66; hip, 33	Height, 66½; hip, 34½	Height, 66½; hip, 36½
1. Waist height..... inches	42½	42	41¾
2. Hip height..... do	34¾	34¾	34¼
3. Weight..... pounds	113	125½	138
4. Stature..... inches	66¼	66¾	66½
5. Cervicale height..... do	56¾	56¾	56¾
6. Tibiale height..... do	18¾	18½	18½
7. Crotch height..... do	31¼	30¾	30¾
8. Bitrochanteric diameter..... do	12	12¾	12¾
9. Shoulder slope..... degrees	25	25	25
10. Anterior chest width..... inches	12¼	12¾	13
11. Anterior waist length..... do	12¾	13½	13¾
12. Posterior chest width..... do	13¾	13¾	14¾
13. Posterior waist length..... do	14¾	15½	15¾
14. Chest girth at armseye..... do	32½	34½	35¾
15. Scye depth..... do	7¼	7¾	7½
16. Posterior hip arc..... do	15¾	16¾	17¾
17. Maximum chest girth..... do	32½	34½	35¾
18. Anterior chest arc..... do	17½	18	18¾
19. Waist girth..... do	26½	27¼	28½
20. Hip girth..... do	32½	34¾	36½
21. Neck-base girth..... do	14¾	15¾	15¾
22. Shoulder length..... do	4½	4¾	4¾
23. Armseye girth..... do	15½	16¾	16¾
24. Upper-arm girth..... do	9¼	10	10¾
25. Elbow girth..... do	10½	11	11¾
26. Upper posterior arm length..... do	13¼	13¾	13¾
27. Total posterior arm length..... do	24¼	24¾	24¾
28. Trunk line..... do	7¾	7¾	7¾
29. Waist to hips..... do	7¾	8	8
30. Thigh girth..... do	18½	19¾	21¾
31. Maximum calf girth..... do	12¾	13¾	14
32. Knee girth..... do	13¾	13¾	14¼
33. Total crotch length..... do	27½	27½	28¾
34. Anterior crotch length..... do	14	14¾	14¾
35. Extreme bend..... do	27¾	28¼	28¾
36. Vertical trunk girth..... do	57¾	58¼	60½
37. Percentage <sup>1</sup> ..... percent	25	44	20

See footnotes at end of table.

TABLE 8.—Proposed system of boys' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1$ ,  $C_1$ ,  $D_1$ , show corresponding intervals on fig. 3) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$B_{13}$	$C_{13}$	$D_{13}$	Item No. and measurement	$B_{13}$	$C_{13}$	$D_{13}$
	Height, $68\frac{1}{2}$ ; hip, 34	Height, $68\frac{1}{2}$ ; hip, 36	Height, 69; hip, $37\frac{1}{2}$		Height, $68\frac{1}{2}$ ; hip, 34	Height, $68\frac{1}{2}$ ; hip, 36	Height, 69; hip, $37\frac{1}{2}$
1. Waist height..... inches	43 $\frac{1}{2}$	43 $\frac{3}{8}$	43 $\frac{3}{8}$	21. Neck-base girth..... do	15 $\frac{3}{8}$	15 $\frac{7}{8}$	16 $\frac{3}{8}$
2. Hip height..... do	35 $\frac{3}{4}$	35 $\frac{1}{2}$	35 $\frac{3}{8}$	22. Shoulder length..... do	4 $\frac{5}{8}$	4 $\frac{3}{4}$	4 $\frac{3}{4}$
3. Weight..... pounds	124 $\frac{1}{2}$	136 $\frac{1}{2}$	151	23. Armscye girth..... do	16 $\frac{1}{8}$	16 $\frac{3}{4}$	17 $\frac{3}{8}$
4. Stature..... inches	68 $\frac{1}{2}$	68 $\frac{5}{8}$	68 $\frac{3}{4}$	24. Upper-arm girth..... do	9 $\frac{5}{8}$	10 $\frac{3}{8}$	11
5. Cervicale height..... do	58 $\frac{5}{8}$	58 $\frac{3}{4}$	58 $\frac{7}{8}$	25. Elbow girth..... do	10 $\frac{7}{8}$	11 $\frac{3}{8}$	11 $\frac{5}{8}$
6. Tibiale height..... do	19 $\frac{1}{8}$	19 $\frac{1}{8}$	19 $\frac{1}{8}$	26. Upper posterior arm length..... do	14 $\frac{1}{4}$	14 $\frac{1}{4}$	14 $\frac{3}{8}$
7. Crotch height..... do	32 $\frac{1}{4}$	31 $\frac{3}{4}$	31 $\frac{3}{4}$	27. Total posterior arm length..... do	25 $\frac{1}{8}$	25 $\frac{1}{4}$	25 $\frac{3}{8}$
8. Bitrochanteric diameter..... do	12 $\frac{3}{8}$	12 $\frac{3}{4}$	13 $\frac{1}{4}$	28. Trunk line..... do	8 $\frac{1}{8}$	8 $\frac{1}{8}$	8 $\frac{1}{8}$
9. Shoulder slope..... degrees	25	25	25	29. Waist to hips..... do	8 $\frac{1}{8}$	8 $\frac{1}{4}$	8 $\frac{1}{4}$
10. Anterior chest width..... inches	12 $\frac{5}{8}$	13	13 $\frac{3}{8}$	30. Thigh girth..... do	19	20 $\frac{3}{8}$	21 $\frac{3}{4}$
11. Anterior waist length..... do	13 $\frac{1}{2}$	13 $\frac{3}{8}$	13 $\frac{7}{8}$	31. Maximum calf girth..... do	13 $\frac{1}{8}$	13 $\frac{3}{4}$	14 $\frac{3}{8}$
12. Posterior chest width..... do	13 $\frac{7}{8}$	14 $\frac{1}{4}$	14 $\frac{3}{4}$	32. Knee girth..... do	13 $\frac{5}{8}$	14 $\frac{1}{8}$	14 $\frac{5}{8}$
13. Posterior waist length..... do	15 $\frac{3}{8}$	15 $\frac{3}{4}$	15 $\frac{7}{8}$	33. Total crotch length..... do	28 $\frac{1}{8}$	28 $\frac{7}{8}$	29 $\frac{3}{8}$
14. Chest girth at armscye..... do	33 $\frac{3}{4}$	35 $\frac{1}{4}$	36 $\frac{3}{4}$	34. Anterior crotch length..... do	14 $\frac{3}{8}$	14 $\frac{3}{4}$	15 $\frac{1}{8}$
15. Seye depth..... do	7 $\frac{5}{8}$	7 $\frac{3}{4}$	7 $\frac{7}{8}$	35. Extreme bend..... do	28 $\frac{7}{8}$	29 $\frac{1}{8}$	29 $\frac{3}{8}$
16. Posterior hip arc..... do	16 $\frac{1}{2}$	17 $\frac{1}{2}$	18 $\frac{1}{2}$	36. Vertical trunk girth..... do	59 $\frac{3}{8}$	60 $\frac{3}{4}$	62 $\frac{1}{4}$
17. Maximum chest girth..... do	33 $\frac{3}{4}$	35 $\frac{1}{4}$	36 $\frac{3}{4}$	37. Percentage..... percent	28	44	18
18. Anterior chest arc..... do	17 $\frac{3}{4}$	18 $\frac{1}{2}$	19 $\frac{3}{8}$				
19. Waist girth..... do	26 $\frac{5}{8}$	27 $\frac{3}{8}$	29 $\frac{3}{8}$				
20. Hip girth..... do	34	35 $\frac{3}{4}$	37 $\frac{5}{8}$				

<sup>1</sup> Based on total number of children in the given height interval.

TABLE 9.—Proposed system of girls' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1, C_1, D_1$ , show corresponding intervals on fig. 4) and designated by approximate height and hip dimensions in inches

Item No. and measurement	$B_1$	$C_1$	$D_1$	Item No. and measurement	$B_3$	$C_3$	$D_3$
	Height, 40½; hip, 20½	Height, 40½; hip, 22	Height, 41; hip, 23½		Height, 45; hip, 22	Height, 45; hip, 23½	Height, 45½; hip, 25
1. Waist height..... inches	24¼	24¾	24¾	1. Waist height..... inches	27½	27¾	27¾
2. Hip height..... do	19¼	19¾	19¾	2. Hip height..... do	22½	22¾	22¾
3. Weight..... pounds	33	36	39½	3. Weight..... pounds	40	44	48
4. Stature..... inches	40¾	40¾	40¾	4. Stature..... inches	44½	45½	45¾
5. Cervicale height..... do	33¾	33¾	33¾	5. Cervicale height..... do	37¼	37¼	37¾
6. Tihiale height..... do	10½	10½	10¾	6. Tihiale height..... do	12	12½	12¾
7. Crotch height..... do	17	17¼	17	7. Crotch height..... do	19¾	19¾	19¾
8. Bitrochanteric diameter..... do	7¼	7½	8	8. Bitrochanteric diameter..... do	7½	8¼	8½
9. Shoulder slope..... degrees	25½	25½	26	9. Shoulder slope..... degrees	25	25½	26
10. Anterior chest width..... inches	7½	7¾	8	10. Anterior chest width..... inches	8½	8½	8½
11. Anterior waist length..... do	8½	8½	8½	11. Anterior waist length..... do	9½	9½	9½
12. Posterior chest width..... do	8½	9½	9¾	12. Posterior chest width..... do	9½	9½	9½
13. Posterior waist length..... do	9¼	9¼	9¾	13. Posterior waist length..... do	10	10½	10½
14. Chest girth at armscye..... do	20½	21½	22¾	14. Chest girth at armscye..... do	22½	22½	23½
15. Seye depth..... do	4½	4½	4½	15. Seye depth..... do	4½	5	5
16. Posterior hip arc..... do	10½	10½	11½	16. Posterior hip arc..... do	10½	11½	12½
17. Maximum chest girth..... do				17. Maximum chest girth..... do			
18. Anterior chest arc..... do	10½	11¼	11½	18. Anterior chest arc..... do	11½	11½	12½
19. Waist girth..... do	18¾	19¼	20¾	19. Waist girth..... do	19½	20½	21
20. Hip girth..... do	20½	21½	23¼	20. Hip girth..... do	22½	23½	24¾
21. Neck-base girth..... do	10½	10½	10¾	21. Neck-base girth..... do	10½	11½	11½
22. Shoulder length..... do	2½	2¾	2¾	22. Shoulder length..... do	3	3½	3½
23. Armscye girth..... do	9¾	9¾	10½	23. Armscye girth..... do	10	10½	10¾
24. Upper-arm girth..... do	6	6¾	6¾	24. Upper-arm girth..... do	6¼	6½	7½
25. Elbow girth..... do	6½	6¾	7¼	25. Elbow girth..... do	7	7½	7½
26. Upper posterior arm length..... do	7½	8	8	26. Upper posterior arm length..... do	8	8	9
27. Total posterior arm length..... do	13½	14¼	14½	27. Total posterior arm length..... do	15½	15¾	15¾
28. Trunk line..... do	4½	4¾	4¾	28. Trunk line..... do	5½	5½	5¼
29. Waist to hips..... do	5½	5¼	5¾	29. Waist to hips..... do	5½	5¾	5¾
30. Thigh girth..... do	11½	12¾	13¼	30. Thigh girth..... do	12½	13¾	14½
31. Maximum calf girth..... do	8½	8¼	8½	31. Maximum calf girth..... do	8½	9½	9½
32. Knee girth..... do	8½	8½	9¼	32. Knee girth..... do	9½	9½	10
33. Total crotch length..... do	17	17¼	18½	33. Total crotch length..... do	18½	18½	19½
34. Anterior crotch length..... do	17	17	9	34. Anterior crotch length..... do	9½	9½	9½
35. Extreme hend..... do	17	17¾	17¾	35. Extreme hend..... do	18½	19¼	19½
36. Vertical trunk girth..... do	36½	36¾	37¾	36. Vertical trunk girth..... do	38½	39¾	40¾
37. Percentage <sup>1</sup> ..... percent	25	56	17	37. Percentage <sup>1</sup> ..... percent	19	55	21

Item No. and measurement	$B_2$	$C_2$	$D_2$	Item No. and measurement	$B_4$	$C_4$	$D_4$
	Height, 42½; hip, 21½	Height, 43; hip, 22½	Height, 43; hip, 24		Height, 47; hip, 23	Height, 47½; hip, 24	Height, 47½; hip, 25½
1. Waist height..... inches	25½	26¼	26¼	1. Waist height..... inches	29½	29¾	29¾
2. Hip height..... do	20¾	20¾	20¾	2. Hip height..... do	23¾	23¾	23¾
3. Weight..... pounds	36½	40	43½	3. Weight..... pounds	44½	48	53
4. Stature..... inches	42¾	42¾	43	4. Stature..... inches	47¼	47½	47¾
5. Cervicale height..... do	35½	35½	35¾	5. Cervicale height..... do	39¼	39¼	39¾
6. Tihiale height..... do	11¼	11¾	12	6. Tihiale height..... do	12¾	12¾	13
7. Crotch height..... do	18¾	18¾	18¾	7. Crotch height..... do	21	21	21
8. Bitrochanteric diameter..... do	8	8¾	8	8. Bitrochanteric diameter..... do	8¼	8½	9
9. Shoulder slope..... degrees	25	25½	25½	9. Shoulder slope..... degrees	25	25½	26
10. Anterior chest width..... inches	7¾	8	8¼	10. Anterior chest width..... inches	8½	8½	8½
11. Anterior waist length..... do	8½	8½	9	11. Anterior waist length..... do	9½	9½	9½
12. Posterior chest width..... do	9¾	9¾	9¾	12. Posterior chest width..... do	9½	10¼	10¼
13. Posterior waist length..... do	9¾	9¾	9¾	13. Posterior waist length..... do	10½	10½	10½
14. Chest girth at armscye..... do	21½	22½	22¾	14. Chest girth at armscye..... do	22½	23½	24¾
15. Seye depth..... do	4½	4¾	4¾	15. Seye depth..... do	5	5½	5¼
16. Posterior hip arc..... do	10½	11¼	11½	16. Posterior hip arc..... do	11½	12	12¾
17. Maximum chest girth..... do				17. Maximum chest girth..... do	22½	23½	24¾
18. Anterior chest arc..... do	11¼	11½	12	18. Anterior chest arc..... do	11½	12½	12¾
19. Waist girth..... do	19	19¾	20¾	19. Waist girth..... do	19¼	20½	21¾
20. Hip girth..... do	21¾	22¾	24	20. Hip girth..... do	22½	24¼	25¾
21. Neck-base girth..... do	10¾	10¾	10¾	21. Neck-base girth..... do	11½	11½	11½
22. Shoulder length..... do	2½	2¾	3	22. Shoulder length..... do	3½	3¼	3¼
23. Armscye girth..... do	9¾	10	10¾	23. Armscye girth..... do	10½	10¾	11
24. Upper-arm girth..... do	6½	6½	7	24. Upper-arm girth..... do	6¾	6¾	7¼
25. Elbow girth..... do	6½	7½	7¾	25. Elbow girth..... do	7¼	7½	7¾
26. Upper posterior arm length..... do	8½	8½	8½	26. Upper posterior arm length..... do	9½	9½	9½
27. Total posterior arm length..... do	14¾	14¾	15	27. Total posterior arm length..... do	16¾	16¾	16¾
28. Trunk line..... do	5½	5½	5	28. Trunk line..... do	5½	5½	5½
29. Waist to hips..... do	5½	5½	5½	29. Waist to hips..... do	5½	5½	6
30. Thigh girth..... do	12½	13	14	30. Thigh girth..... do	13	13½	14½
31. Maximum calf girth..... do	8½	8¾	9¼	31. Maximum calf girth..... do	9	9½	9½
32. Knee girth..... do	8½	9¼	9½	32. Knee girth..... do	9½	9½	10½
33. Total crotch length..... do	17¾	18¼	18½	33. Total crotch length..... do	19½	19¾	20¾
34. Anterior crotch length..... do	9	9¼	9¼	34. Anterior crotch length..... do	9½	9½	10
35. Extreme hend..... do	17½	18¼	18¾	35. Extreme hend..... do	19½	20¼	20¾
36. Vertical trunk girth..... do	37¾	38¼	39¼	36. Vertical trunk girth..... do	40¼	41	41½
37. Percentage <sup>1</sup> ..... percent	23	56	18	37. Percentage <sup>1</sup> ..... percent	17	50	26

See footnotes at end of table.

TABLE 9.—Proposed system of girls' body measurements based on intervals of height and hip measure (symbols, *i. e.*,  $B_1, C_1, D_1$ , show corresponding intervals on fig. 4) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	$B_5$	$C_5$	$D_5$	Item No. and measurement	$B_7$	$C_7$	$D_7$
	Height, 49½; hip, 24	Height, 50; hip, 25½	Height, 50; hip, 27		Height, 54½; hip, 26½	Height, 54½; hip, 28	Height, 54½; hip, 30
1. Waist height.....inches	31	31¼	31¾	1. Waist height.....inches	34½	34¾	34¾
2. Hip height.....do	25	25¼	25¾	2. Hip height.....do	28	28	28¼
3. Weight.....pounds	49½	54	59	3. Weight.....pounds	63	69	77½
4. Stature.....inches	49¾	49¾	50	4. Stature.....inches	63	64½	65½
5. Cervicale height.....do	41¾	41¾	41¾	5. Cervicale height.....do	45¾	46	46¼
6. Tibiale height.....do	13¾	13¾	13¾	6. Tibiale height.....do	15¾	15¾	15¾
7. Crotch height.....do	22¾	22¾	22¾	7. Crotch height.....do	25¾	25¾	25
8. Bitrochanteric diameter.....do	8¾	9	9¾	8. Bitrochanteric diameter.....do	9½	10	10½
9. Shoulder slope.....degrees	25	25½	25½	9. Shoulder slope.....degrees	25	25	25
10. Anterior chest width.....inches	8¾	9	9¾	10. Anterior chest width.....inches	9¾	9¾	10¼
11. Anterior waist length.....do	10	10	10	11. Anterior waist length.....do	10½	10½	10¾
12. Posterior chest width.....do	10¼	10¼	10½	12. Posterior chest width.....do	11	11¼	11½
13. Posterior waist length.....do	10¾	10¾	11	13. Posterior waist length.....do	11¾	11¾	11¾
14. Chest girth at armscye.....do	23¾	24¾	25¼	14. Chest girth at armscye.....do	25¾	26¼	27¾
15. Scye depth.....do	5¼	5¾	5¾	15. Scye depth.....do	5¾	5¾	6
16. Posterior hip arc.....do	11¾	12¼	13¾	16. Posterior hip arc.....do	13¼	14	15
17. Maximum chest girth.....do	23¾	24¼	25¼	17. Maximum chest girth.....do	25¾	26¼	27¾
18. Anterior chest arc.....do	12¾	12¾	13¾	18. Anterior chest arc.....do	13¼	14½	14¾
19. Waist girth.....do	20¼	21¾	22	19. Waist girth.....do	21½	22¾	24
20. Hip girth.....do	24	25¾	26¾	20. Hip girth.....do	26¾	28¼	30¼
21. Neck-hase girth.....do	11¾	11¾	11¾	21. Neck-hase girth.....do	12¼	12¾	12¾
22. Shoulder length.....do	3¾	3¾	3¾	22. Shoulder length.....do	3¾	3¾	3¾
23. Armscye girth.....do	10¾	11½	11½	23. Armscye girth.....do	11¾	12¼	12¾
24. Upper-arm girth.....do	6¾	7	7½	24. Upper-arm girth.....do	7¼	7¾	8¼
25. Elbow girth.....do	7¼	7¾	8¼	25. Elbow girth.....do	8¼	8¼	8¼
26. Upper posterior arm length.....do	9¾	10	10	26. Upper posterior arm length.....do	11	11¼	11¼
27. Total posterior arm length.....do	17¾	17¾	17¾	27. Total posterior arm length.....do	19½	19½	19½
28. Trunk line.....do	5¾	5¾	5¾	28. Trunk line.....do	6¼	6¼	6¼
29. Waist to hips.....do	6¼	6¼	6¼	29. Waist to hips.....do	6¾	6¾	7
30. Thigh girth.....do	13¾	14¾	15¾	30. Thigh girth.....do	15¼	16¾	17¾
31. Maximum calf girth.....do	9¾	10¼	10¼	31. Maximum calf girth.....do	10¾	10¾	11¾
32. Knee girth.....do	10	10¾	10¾	32. Knee girth.....do	10¾	11¾	12
33. Total crotch length.....do	20	20¾	21¼	33. Total crotch length.....do	21¾	22¾	23¾
34. Anterior crotch length.....do	10	10¼	10½	34. Anterior crotch length.....do	10¾	11¼	11¾
35. Extreme bend.....do	21	21¾	21¾	35. Extreme bend.....do	23¼	23¼	24¼
36. Vertical trunk girth.....do	41¾	42¾	43¼	36. Vertical trunk girth.....do	45¾	46¼	47¾
37. Percentage <sup>1</sup> .....percent	19	47	24	37. Percentage <sup>1</sup> .....percent	29	43	18

Item No. and measurement	$B_6$	$C_6$	$D_6$	Item No. and measurement	$B_8$	$C_8$	$D_8$
	Height, 52; hip, 25	Height, 52; hip, 27	Height, 52; hip, 28½		Height, 57; hip, 28	Height, 57; hip, 30	Height, 57; hip, 32
1. Waist height.....inches	32¾	32¾	33¼	1. Waist height.....inches	36¼	36¾	36½
2. Hip height.....do	26¾	26¾	26¾	2. Hip height.....do	29¾	29¾	29¾
3. Weight.....pounds	55½	61	68	3. Weight.....pounds	71	78	87½
4. Stature.....inches	51¾	52¾	52¼	4. Stature.....inches	56¾	56¾	57
5. Cervicale height.....do	43½	43	44	5. Cervicale height.....do	48	48¼	48½
6. Tibiale height.....do	14¾	14¾	14¾	6. Tibiale height.....do	15¾	16	16
7. Crotch height.....do	23¾	23¾	23¾	7. Crotch height.....do	26¼	26¼	26
8. Bitrochanteric diameter.....do	9	9	9¾	8. Bitrochanteric diameter.....do	10	10½	11½
9. Shoulder slope.....degrees	25	25	25½	9. Shoulder slope.....degrees	25	25	25
10. Anterior chest width.....inches	9¼	9¾	9¾	10. Anterior chest width.....inches	10	10¼	10½
11. Anterior waist length.....do	10¾	10¾	10¾	11. Anterior waist length.....do	10¾	11	11¾
12. Posterior chest width.....do	10¾	10¾	11	12. Posterior chest width.....do	11½	11¾	12
13. Posterior waist length.....do	11¼	11¾	11¾	13. Posterior waist length.....do	12¼	12¾	12¾
14. Chest girth at armscye.....do	24½	25¾	26¼	14. Chest girth at armscye.....do	26¾	27¾	29¼
15. Scye depth.....do	5½	5¾	5¾	15. Scye depth.....do	5¾	6	6¾
16. Posterior hip arc.....do	12¾	13¼	14¼	16. Posterior hip arc.....do	13¾	14¾	15¼
17. Maximum chest girth.....do	24¾	25¾	26¾	17. Maximum chest girth.....do	26¾	27¾	29¾
18. Anterior chest arc.....do	12¾	13¼	14¾	18. Anterior chest arc.....do	14¾	14¾	15¼
19. Waist girth.....do	20¾	21¾	23¾	19. Waist girth.....do	22¾	23¾	24¾
20. Hip girth.....do	25	26¼	28½	20. Hip girth.....do	28¾	29¾	31¼
21. Neck-hase girth.....do	11¾	12	12¼	21. Neck-hase girth.....do	12¾	12¾	13¾
22. Shoulder length.....do	3½	3¾	3¾	22. Shoulder length.....do	3¾	3¾	4
23. Armscye girth.....do	11¼	11¾	12¾	23. Armscye girth.....do	12¾	12¾	13¾
24. Upper-arm girth.....do	6¾	7¾	8	24. Upper-arm girth.....do	7¾	8¼	8¾
25. Elbow girth.....do	7¾	8¼	8¼	25. Elbow girth.....do	8¼	8¼	8¼
26. Upper posterior arm length.....do	10½	10½	10½	26. Upper posterior arm length.....do	11¾	11¾	11¾
27. Total posterior arm length.....do	18¾	18½	18¾	27. Total posterior arm length.....do	20¾	20¾	20¾
28. Trunk line.....do	6	6	5¾	28. Trunk line.....do	6¾	6¾	6¾
29. Waist to hips.....do	6¼	6¾	6¾	29. Waist to hips.....do	7	7¾	7¾
30. Thigh girth.....do	14¾	15¾	16¾	30. Thigh girth.....do	16	17¼	18¾
31. Maximum calf girth.....do	10¼	10¼	11¾	31. Maximum calf girth.....do	10¾	11¼	11¾
32. Knee girth.....do	10¾	11	11¾	32. Knee girth.....do	11¾	12	12¼
33. Total crotch length.....do	20¾	21¾	22½	33. Total crotch length.....do	22¾	23¼	24¾
34. Anterior crotch length.....do	10¾	10¾	11¾	34. Anterior crotch length.....do	11¾	11¾	12¼
35. Extreme bend.....do	22	22½	23	35. Extreme bend.....do	24¼	24¾	25¾
36. Vertical trunk girth.....do	43¾	44½	45¾	36. Vertical trunk girth.....do	47¾	48¾	50
37. Percentage <sup>1</sup> .....percent	21	51	21	37. Percentage <sup>1</sup> .....percent	30	36	19

See footnotes at end of table.



TABLE 9.—Proposed system of girls' body measurements based on intervals of height and hip measure (symbols, *i. e.*, B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub>, show corresponding intervals on fig. 4) and designated by approximate height and hip dimensions in inches—Continued

Item No. and measurement	B <sub>9</sub>	C <sub>9</sub>	D <sub>9</sub>
	Height, 59; hip, 30	Height, 59½; hip, 32	Height, 59½; hip, 34
1. Waist height..... inches	37½	38	38
2. Hip height..... do	30⅝	30⅝	30⅝
3. Weight..... pounds	81½	90	99½
4. Stature..... inches	59⅝	59⅝	59½
5. Cervicale height..... do	50¼	50½	50¼
6. Tibiale height..... do	16⅝	16⅝	16½
7. Crotch height..... do	27¼	27¼	27½
8. Bitrochanteric diameter..... do	10¾	11¼	11⅝
9. Shoulder slope..... degrees	25	25	25
10. Anterior chest width..... inches	10½	10⅝	11¼
11. Anterior waist length..... do	11⅝	11½	11¼
12. Posterior chest width..... do	11⅝	12¼	12½
13. Posterior waist length..... do	12⅝	13½	13⅝
14. Chest girth at armscye..... do	28½	29⅝	30¼
15. Scye depth..... do	6¼	6⅝	6⅝
16. Posterior hip arc..... do	14¾	15¾	16⅝
17. Maximum chest girth..... do	28¼	29⅝	31¼
18. Anterior chest arc..... do	14⅝	15½	16⅝
19. Waist girth..... do	23¼	24⅝	25
20. Hip girth..... do	30	31⅝	33¼
21. Neck-base girth..... do	13	13⅝	13¼
22. Shoulder length..... do	4	4⅝	4⅝
23. Armscye girth..... do	13	13½	14
24. Upper-arm girth..... do	8	8½	9¼
25. Elbow girth..... do	9	9⅝	9⅝
26. Upper posterior arm length..... do	12⅝	12¼	12⅝
27. Total posterior arm length..... do	21⅝	21½	21⅝
28. Trunk line..... do	6⅝	6⅝	6⅝
29. Waist to hips..... do	7⅝	7⅝	7⅝
30. Thigh girth..... do	17	18¼	19⅝
31. Maximum calf girth..... do	11¼	11⅝	12⅝
32. Knee girth..... do	12	12½	12⅝
33. Total crotch length..... do	24½	25	26
34. Anterior crotch length..... do	11⅝	12⅝	12¼
35. Extreme bend..... do	25⅝	26½	26⅝
36. Vertical trunk girth..... do	49⅝	51⅝	52¼
37. Percentage <sup>1</sup> ..... percent	26	30	21

Item No. and measurement	B <sub>10</sub>	C <sub>10</sub>	D <sub>10</sub>
	Height, 61½; hip, 32	Height, 61½; hip, 34	Height, 62; hip, 36
1. Waist height..... inches	39¼	39¼	39¼
2. Hip height..... do	31¾	31⅝	31½
3. Weight..... pounds	92½	102	112
4. Stature..... inches	61½	61⅝	61⅝
5. Cervicale height..... do	52½	52⅝	52¾
6. Tibiale height..... do	17¼	17⅝	17⅝
7. Crotch height..... do	28⅝	28¼	28
8. Bitrochanteric diameter..... do	11½	12	12⅝
9. Shoulder slope..... degrees	25	25	24
10. Anterior chest width..... inches	11	11⅝	11⅝
11. Anterior waist length..... do	11⅝	12¼	12¼
12. Posterior chest width..... do	12⅝	12⅝	12⅝
13. Posterior waist length..... do	13⅝	13½	14
14. Chest girth at armscye..... do	29½	30⅝	32⅝
15. Scye depth..... do	6¼	6⅝	6⅝
16. Posterior hip arc..... do	15¾	16¾	17⅝
17. Maximum chest girth..... do	29½	31½	32¾
18. Anterior chest arc..... do	15⅝	16½	17¼
19. Waist girth..... do	23½	24⅝	25⅝
20. Hip girth..... do	32	33⅝	35¼
21. Neck-base girth..... do	13½	13⅝	14⅝
22. Shoulder length..... do	4¼	4¼	4¼
23. Armscye girth..... do	13⅝	14¼	14⅝
24. Upper-arm girth..... do	8⅝	9	9⅝
25. Elbow girth..... do	9⅝	9⅝	9⅝
26. Upper posterior arm length..... do	12⅝	12⅝	12⅝
27. Total posterior arm length..... do	22¼	22¾	22½
28. Trunk line..... do	7¼	7¼	7¼
29. Waist to hips..... do	7⅝	8	8¼
30. Thigh girth..... do	18½	19⅝	20¾
31. Maximum calf girth..... do	11½	12⅝	13
32. Knee girth..... do	12½	12⅝	13⅝
33. Total crotch length..... do	25½	26¼	27⅝
34. Anterior crotch length..... do	12½	13⅝	13⅝
35. Extreme bend..... do	26¾	27¼	27¼
36. Vertical trunk girth..... do	52¼	53¼	55
37. Percentage <sup>1</sup> ..... percent	20	32	26

Item No. and measurement	B <sub>11</sub>	C <sub>11</sub>	D <sub>11</sub>
	Height, 64; hip, 33½	Height, 64; hip, 35½	Height, 64; hip, 37
1. Waist height..... inches	40⅝	40⅝	40¾
2. Hip height..... do	32⅝	32¾	32¾
3. Weight..... pounds	103	112½	123½
4. Stature..... inches	63¼	63⅝	64
5. Cervicale height..... do	54½	54⅝	54¾
6. Tibiale height..... do	17¼	17⅝	17¾
7. Crotch height..... do	29⅝	29¼	29¼
8. Bitrochanteric diameter..... do	12	12⅝	13⅝
9. Shoulder slope..... degrees	25	25	24½
10. Anterior chest width..... inches	11½	11⅝	12⅝
11. Anterior waist length..... do	12⅝	12⅝	12¾
12. Posterior chest width..... do	12¼	13	13¼
13. Posterior waist length..... do	14¼	14⅝	14⅝
14. Chest girth at armscye..... do	30¾	32	33¼
15. Scye depth..... do	6⅝	7	7¼
16. Posterior hip arc..... do	16½	17½	18½
17. Maximum chest girth..... do	31¼	32⅝	33½
18. Anterior chest arc..... do	16⅝	17⅝	17¾
19. Waist girth..... do	24⅝	25⅝	26½
20. Hip girth..... do	33⅝	35⅝	37¼
21. Neck-base girth..... do	14	14¼	14½
22. Shoulder length..... do	4⅝	4⅝	4⅝
23. Armscye girth..... do	14⅝	14⅝	15
24. Upper-arm girth..... do	8¾	9⅝	10
25. Elbow girth..... do	9⅝	9⅝	10¼
26. Upper posterior arm length..... do	13¼	13¼	13⅝
27. Total posterior arm length..... do	23½	23¼	23⅝
28. Trunk line..... do	7¼	7⅝	7⅝
29. Waist to hips..... do	8⅝	8⅝	8⅝
30. Thigh girth..... do	19	20⅝	21¾
31. Maximum calf girth..... do	12¼	12⅝	13⅝
32. Knee girth..... do	12⅝	13¼	13¾
33. Total crotch length..... do	26⅝	27¼	28½
34. Anterior crotch length..... do	13	13½	13⅝
35. Extreme bend..... do	28	28⅝	28⅝
36. Vertical trunk girth..... do	54½	55⅝	57
37. Percentage <sup>1</sup> ..... percent	21	38	24

Item No. and measurement	B <sub>12</sub>	C <sub>12</sub>	D <sub>12</sub>
	Height, 66; hip, 35	Height, 66; hip, 36½	Height, 66; hip, 38½
1. Waist height..... inches	42¼	42⅝	42¼
2. Hip height..... do	34½	34	34
3. Weight..... pounds	112	122½	134
4. Stature..... inches	66	66⅝	66⅝
5. Cervicale height..... do	56¼	56⅝	56¾
6. Tibiale height..... do	18⅝	18⅝	18⅝
7. Crotch height..... do	30⅝	30⅝	30¾
8. Bitrochanteric diameter..... do	12½	13	13½
9. Shoulder slope..... degrees	25¼	25	24½
10. Anterior chest width..... inches	11½	12⅝	12½
11. Anterior waist length..... do	12⅝	13	13⅝
12. Posterior chest width..... do	13½	13⅝	13⅝
13. Posterior waist length..... do	14¾	14⅝	14⅝
14. Chest girth at armscye..... do	31½	32¾	34
15. Scye depth..... do	7¼	7¼	7½
16. Posterior hip arc..... do	17½	18	19
17. Maximum chest girth..... do	32½	33⅝	34⅝
18. Anterior chest arc..... do	16¾	17½	18⅝
19. Waist girth..... do	24¾	25⅝	26¾
20. Hip girth..... do	34¼	36⅝	38½
21. Neck-base girth..... do	14⅝	14⅝	14¾
22. Shoulder length..... do	4½	4½	4½
23. Armscye girth..... do	14½	15	15½
24. Upper-arm girth..... do	9	9⅝	10
25. Elbow girth..... do	9⅝	10¼	10¼
26. Upper posterior arm length..... do	13⅝	13¼	13⅝
27. Total posterior arm length..... do	24	24½	24¾
28. Trunk line..... do	7¼	7¾	7¾
29. Waist to hips..... do	8⅝	8⅝	8⅝
30. Thigh girth..... do	19½	21½	22½
31. Maximum calf girth..... do	12⅝	13¼	13¾
32. Knee girth..... do	13⅝	13⅝	14½
33. Total crotch length..... do	27⅝	28⅝	29
34. Anterior crotch length..... do	13⅝	13⅝	14¼
35. Extreme bend..... do	29	29⅝	29⅝
36. Vertical trunk girth..... do	56¼	57½	58⅝
37. Percentage <sup>1</sup> ..... percent	25	38	22

<sup>1</sup> Based on total number of children in the given height interval.

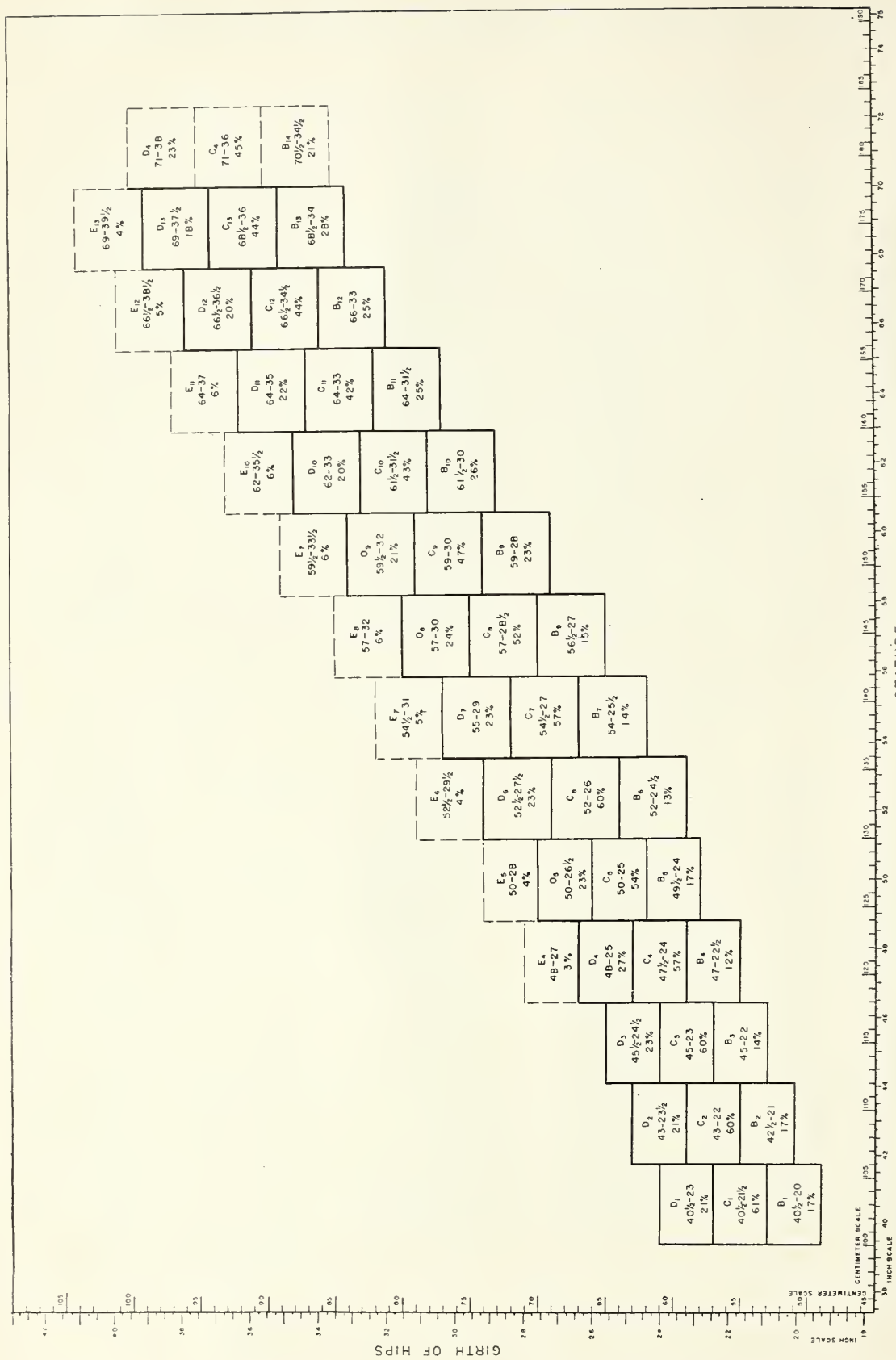


Figure 3.—System of boys' sizes based on stature and girth of hips following the distribution shown in figure 1. The symbols, B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub>, and others in the sequence, designating rectangles outlined by unbroken lines, refer to the "below regular," "regular," and "above regular" sizes as given in table 8. Rectangles outlined by dotted lines show sizes for children whose proportions vary from those of the majority. The percentages are based on the total number of children in a given height interval.

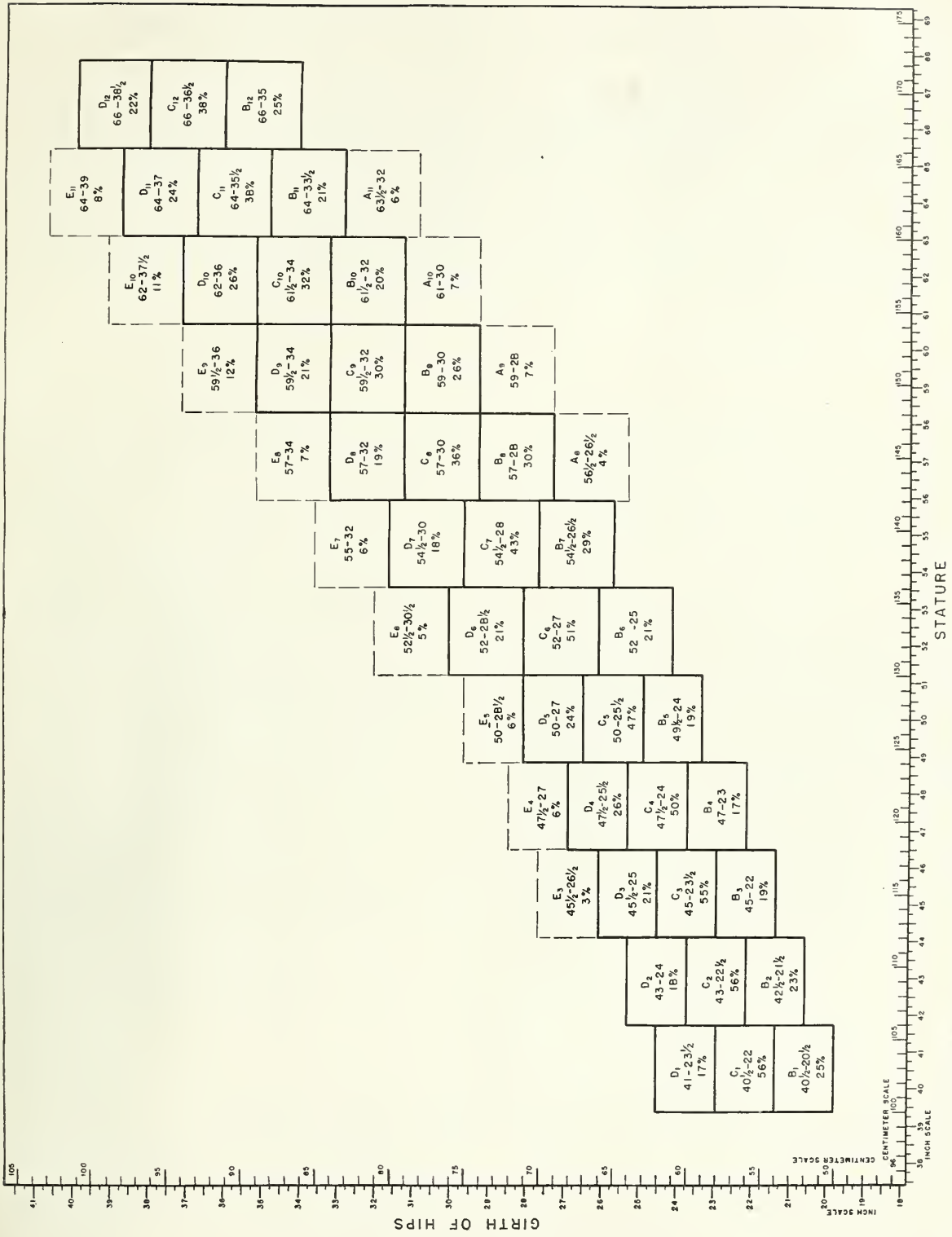


Figure 4.—System of girls' sizes based on stature and girth of hips following the distribution shown in figure 2. The symbols, B, C, D, and others in the sequence, designating rectangles outlined by unbroken lines, refer to the "below regular," "regular," and "above regular" sizes as given in table 9. Rectangles outlined by dotted lines show sizes for children whose proportions vary from those of the majority. The percentages are based on the total number of children in a given height interval.

### *Proposed System not Based on Age*

The proposed system is based on stature and hip measure and has no relation to age sizes.

Since children 4 to 17 years of age were included, the system applies to children of these ages. However, many 2- and 3-year-olds will undoubtedly be included in the small sizes, and children older than 17 will be included in the large ones. This depends on their height and their hip measure. Similarly some 4- and 5-year-olds will be too small for these sizes, and some 16- and 17-

year-olds will be too large. In other words, boys who have the height and hip combinations that come within the range of  $39\frac{1}{2}$  inches and 70 inches for height and  $19\frac{1}{4}$  inches and 39 inches for hip measure and girls who have the height and hip combinations which come within the range of  $39\frac{1}{2}$  inches and  $67\frac{3}{4}$  inches for height and  $19\frac{3}{4}$  inches and 40 inches for hip measure will be included regardless of their age. Those who are shorter or taller or who have smaller or larger hips than are represented in these ranges are not considered in this scheme.

## APPENDIX

# Measurements and Methods of Taking Them

From the technical report submitted by Eleanor P. Hunt, *associate anthropometrist*

The measurements listed below are included in the proposed standard system of body measurements.

1. Height of waist.
2. Height of hips.
3. Weight.
4. Stature.
5. Height of cervicale.
6. Height of tibiale.
7. Height of crotch.
8. Bitrochanteric diameter.
9. Slope of shoulder, right.
10. Width of chest, front.
11. Length of waist, front.
12. Width of chest, back.
13. Length of waist, back.
14. Girth of the chest at the armseye.
15. Depth of scye.
16. Back arc of hips.
17. Maximum girth of chest.
18. Front arc of the chest.
19. Girth of waist.
20. Girth of the hips.
21. Girth of the neck base.
22. Shoulder length, right.
23. Girth of the armseye, right.
24. Girth of the upper arm, right.
25. Girth of the elbow, right.
26. Length of right arm, upper segment, back surface.
27. Total length of right arm, back.
28. Trunk line, right.
29. Length from waist to hip, right.
30. Maximum girth of the thigh, right.
31. Maximum girth of calf, right.
32. Girth of the knee at tibiale right.
33. Length of crotch, total.
34. Length of the crotch, front.
35. Extreme bend.
36. Trunk girth, vertical.

The instruments used in the study consisted of a calibrated anthropometer and steel tape similar to standard anthropometric instruments, a pair of calipers for making bisections of distances, and an instrument for measuring shoulder slope which was devised in the Bureau. A skin pencil was supplied for placing the landmarks on the body, a steel knitting needle to use as a ruler in establishing needed vertical lines, and a small chain to outline the neck

base. All measurements except weight and shoulder slope were taken in the metric system.

The landmarks described below are placed on the body with a skin pencil and used later as reference points for the measurements. They are grouped here in the following order: Neck, trunk, arm, hip, and leg, although in the study, a different order was used which permitted greater speed in the routine measuring.

### *Placing the Landmarks*

*The neck base.*—A fine-gage, flexible-link chain is looped around the neck so that it touches the upper border of the medial ends of the clavicles (fig. 5) and rests on the cervicale (fig. 6). While the chain is in place its position is marked in the center front and over the trapezius muscle on the right and left side. A short vertical line intersecting the neck base is drawn at the center front. A cross is placed at the cervicale on the prominence of the spinous process of the seventh cervical vertebra. This prominence is found more readily when the head is forward, but the landmark is made when the skin is in normal position and the head erect.

*The armseyes.*—The position of the seam of a set-in sleeve is marked on the right and left arms by the use of four landmarks. The determining points are the shoulder, the armseye back and front, and the underarm midpoint. The procedure of locating the landmarks is identical for the right and left sides and will be described for the right side only.

The shoulder point desired is midway between the acromion and the highest point at the lateral end of the clavicle (fig. 6).

In this study the point marked as the acromion is on the side of the acromial process midway between a point in front of the angle of the process and a point at the center of the shoulder, as judged by sighting. The first step is to outline the side of the acromial process. Points are then placed on the outline at the angle of the process and at the sighted center of the shoulder. A line intersecting the outline of the process is placed midway between these two points, and the intersection marked as the acromion.

This position corresponds very closely to the acromion as defined anatomically as the most lateral point of the margin of the acromial process. The use of the midpoint between these easily located limits makes it easier to locate the most lateral point of the process. The highest

point at the lateral end of the clavicle is then found and marked. When the acromion and the highest point of the side of the clavicle have thus been placed, the shoulder point of the armscye is located midway between these points.

The back and front of the armscye are traced with the aid of a chalked string. The center of the string is placed under the arm when the arm is raised about  $30^\circ$  from the trunk. The ends of the string are raised and crossed up over the shoulder point, thus indicating the direction of the armscye at the back and front, as well as under the arm (figs. 5 and 6). The chalked path of the armscye is marked with the skin pencil in short, thin, sloping lines.

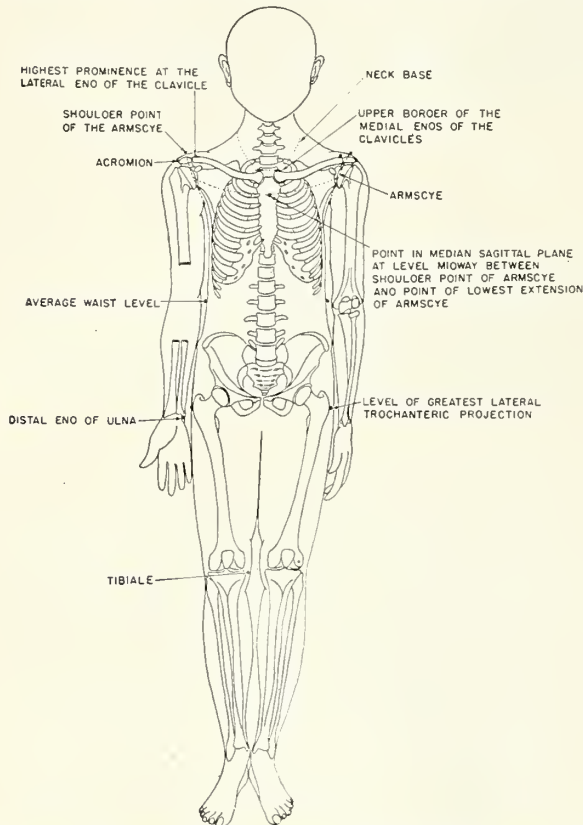


FIGURE 5.—Body landmarks used in taking measurements. Front view.

These lines are placed on the front and back of each shoulder and on the top of the right shoulder but not under the arm.

The underarm midpoint is located with reference to the natural folds in the armpit and the total width of the shoulder. The height of the midpoint in the armpit is decided on the basis of the size and position of the folds. The observer sits in front of the subject and observes the formation of the folds on the right and left sides as the arms are raised to about  $45^\circ$  and gradually lowered to meet the trunk. Usually the folds of one armpit are more clearly defined than those of the other. The level of the midpoint is set with respect to the more clearly defined folds, and a corresponding level is marked off in the pit of the arm on the opposite side. A short, thin, slightly curved line on the trunk marks the underarmscye level.

A vertical line indicating half of the total width of the shoulder is drawn through this to give the underarm midpoint of the trunk. This bisection of the shoulder is made with a small caliper. The upper edge of the shaft of the caliper is held against the trunk at the level of the armscye. The shaft is horizontal, and the jaws are in a vertical position. The jaws touch the shoulder at the back and front without constricting it. The subject's arm is raised to the side at an angle of approximately  $90^\circ$  with as little elevation of the shoulder as possible. With the caliper in this position, the midpoint of the total width is marked with the skin pencil.

The position of the underarm midpoints on the arm as well as on the trunk should take clothing construction into account. The measurer must decide to what height under

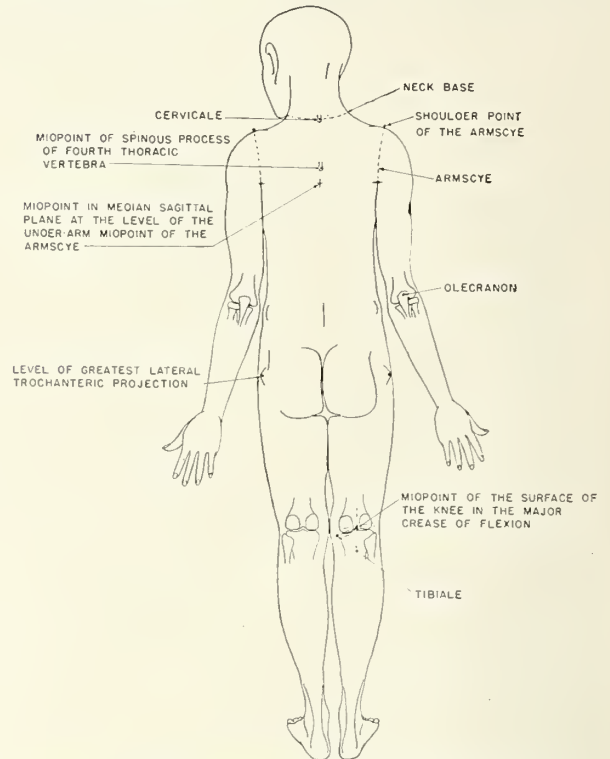


FIGURE 6.—Body landmarks used in taking measurements. Back view.

the arm the blouse can extend without forming an uncomfortable surplus of fabric when the arm is lowered. This depends on the position of the armpit folds on the subject being measured. The highest level considered feasible is the one chosen.

*The shoulder line.*—This line intersects the neck base and the armscye at the shoulder. It corresponds to the customary shoulder seam of a garment and is located with reference to the trapezius muscle and the acromion. By feeling at the neck base, the border of the upper fibers of the trapezius which pass forward and downward to become inserted in the acromial end of the clavicle will be found. The intersection of the shoulder line with the neck base is placed at the front border of the trapezius. The other end of the shoulder line is directed by the acromion, although the intersection of the shoulder line is actually with the

armscye. A small steel knitting needle may be used to guide the observer so that the neck base and armscye intersections can readily be placed with respect to the trapezius border and the acromion.

*Average waist level.*—The waist level used lies at the lower edge of the lowest rib and is found by feeling the sides of the body in line with the armpit. This waist level corresponds very closely to the natural waist which can be seen when the side profiles of the body are slightly concave. A natural waist in this sense does not often occur among young children, but a waist level based on the lower edge of the lowest rib found by feeling at the side of the body can be used equally well in all age groups. This waist level also provides for the maximum depth of a garment from the waist to the crotch level. In this respect, it is preferable to a waist placed at the crest of the ilium, a level which is readily determined, but results in a waist of minimum height and in shallow crotch measurements.

To locate the waist, the observer sits in front of the subject and feels the right and left sides simultaneously, using the index fingers to press against the sides in line with the armpits. The hands are held with the palms directed toward the floor. The fingers are extended and together. The thumb side of the middle joint of the index finger is placed against the subject. When the lower edge of the lowest rib is felt on the back surface of the index finger, the level of the midline of the index finger is taken as the waist level. Without displacing the skin, the level is marked with a point in line with the armpit on the right and left sides. The waist levels of the right and left sides frequently differ. The average height from the floor of the two sides is considered the waist level. The anthropometer is used to find the average height at the center front, center back, and at the right side of the back. If the difference in height between the right and left sides exceeds 4 millimeters, the points first placed on the sides are corrected to correspond with the average height of waist.

The finished landmarks of the waist are five in number: center back, center front, each side, and the right side of the back. Small crosses composed of two short, straight, thin lines at right angles, similar to those at the neck base and cervicale are used. The horizontal branches indicate average height of waist. The intersection at the right side of the back is located by bisecting the distance measured with the tape between the center back and the center side.

*Levels for the measurement of width of chest.*—Short, straight, thin lines are used to indicate the levels on the back and chest at which the width of chest between the armscyes is measured. On the back, the landmark is placed in the center on the prominence of the spinous process of the fourth thoracic vertebra. The landmark on the chest is placed at a level midway between that of the shoulder point of the armscye and the level of the lowest visible point of the armscye. The latter point is indicated by placing a pencil under the arm so that the blunt end is visible at the juncture of the arm and trunk.

*Level for the measurement of maximum chest girth.*—To guide the measurer in placing his tape at the level at which the girth of chest appears to be the greatest, a landmark is placed at this level after observing carefully the outline of the chest. The region of the chest is viewed from one side, and the back and front profiles of the body are considered. A preliminary landmark is placed at the level at which it appears that the girth will be the greatest. This may be placed on the back or the front according to convenience. Similarly, preliminary landmarks are placed when the subject is viewed from the opposite side. The average height of the two preliminary landmarks is taken at the level of maximum chest girth. The final landmark may be placed in the center back or, if the front profile has been used to set preliminary landmarks, it may be

more convenient to place the final landmark on the front.

On boys younger than 11 years of age, these landmarks are not used, and the measurement of maximum girth of chest is omitted. Landmarks and measurements are also omitted on girls younger than 10 years. Among the girls in the older age groups, the level corresponds to the bust measurement.

*Elbow, right.*—The length of the upper segment of the arm is measured from the armscye-shoulder line intersection

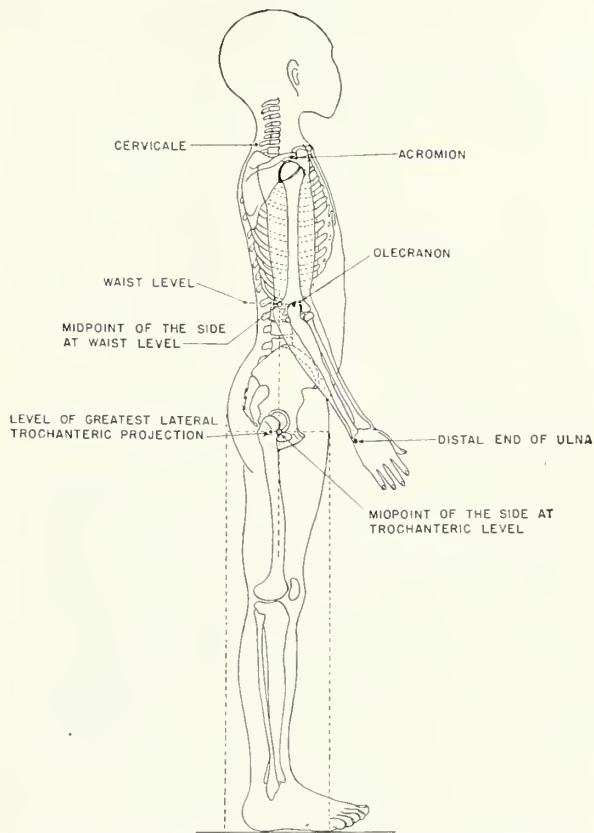


FIGURE 7.—Body landmark used in taking measurements. Side view.

tion to the elbow. The elbow is marked at the point farthest to the side when the closed fist is rested against the waist with the back of the hand facing the front.

*Wrist, right.*—The total length of the arm is measured from the armscye-shoulder line intersection over the elbow to the farther (distal) end of the ulna at the wrist (figs. 5 and 7). To locate the end of the ulna, the flat of the thumbnail of the observer is pushed upward against the end of the ulna on the side corresponding to the little finger. A short line is drawn perpendicular to the long axis of the ulna. An intersecting line is placed at right angles to this in the middle of the side of the wrist corresponding to the little finger.

*Average hip level.*—The level of the hip is placed at the most prominent bony point in the region of the trochanter major. The level is determined independently for the right and left sides. The levels of the two sides usually differ, and the average of the two is taken as the hip level. The preliminary landmarks are corrected to correspond with

the average if the difference between the two sides exceeds 1 mm.

The extended index and middle fingers of the observer's right hand are used to feel the region of the trochanter. This is done while the observer squats with eyes approximately at the level of the trochanter. The direction of palpation is from below upward. On well-developed, muscular individuals and when excessive fat pads are present, it will take some time to find the proper level. The subject may be asked to bend slightly forward or rotate the femur by turning the toes laterally and by pivoting on the heel. A rounded region is felt rather than a point. The midpoint of this region is marked with a preliminary point to indicate the hip level. The average hip level is marked with a short horizontal line.

A point on this horizontal line corresponding to the location of the side seam of a garment is obtained by sighting between the greatest projection of the buttocks and the front projection of the thigh. This is done by the observer squatting at the side of the subject with eyes at the hip level, holding the knitting needle and skin pencil tangent to the buttocks and thigh profiles, respectively, at their most projected parts. The midpoint between these two is determined and marked on the hip-level line. When this point is set, the knitting needle is held vertically and used as a ruler to extend a line from this point to the waist level. The point where it meets the waist level is marked (fig. 7).

The crotch center corresponds to the intersection of the inside seams of trouser legs with the crotch seams. The subject rests his left foot on a chair while this landmark is placed. The observer squats at the left side of the subject with his eyes at the level of the fold of the left buttock and directly in front of the inner surface of the right thigh. The subject's right foot is placed straight forward. The middle line of the inner surface of the right thigh is sighted and marked with a thin vertical line extending downward from the level of the perineum. If the lower borders of the measuring suit obscure the region, the subject is asked to draw them up by lifting the suit by the waist band.

*Knee center at back.*—The height of this landmark is determined with reference to the natural creases of the skin at the back of the knee. By flexing the subject's knee, the creases can be clearly seen. The direction of the most pronounced crease is outlined. A vertical intersection is drawn in the middle line of the back region of the knee.

*Tibiale, right.*—In this study the middle of the "cleft" between the bones that meet at the knee has been used as a guide. The cleft is located by grasping the knee firmly while it is alternately flexed and extended and by moving the index finger or thumb in the region of the cleft with pressure until the margins of the bones are found. The tibiale is marked by a dot as shown in figure 6 at the level of the cleft which corresponds to the highest point which can be felt at the end of the tibia. In practice the midlevel of the cleft gives a close approximation of the tibiale.

## *Procedure Followed in Taking Measurements*

After all the landmarks have been penciled on the body the measurements are taken as described below.

1. *Height of waist.*—This measurement is the average height of the preliminary landmarks set at the waist. The subject stands erect facing the observer with feet together. His weight is evenly distributed between the two feet and he is cautioned against shifting his weight

from one foot to the other and from heels to toes and vice versa. His arms hang loosely at the side, somewhat toward the back. The observer sits in front of the subject or stands when the height of waist equals or exceeds 1 m. The measurement is taken with the anthropometer, and the leveling platform is used if the floor of the workroom is not level.

2. *Height of hips.*—This is the average height of the preliminary landmarks placed on the right and left sides in the region of the trochanters and is taken with the anthropometer, the leveling platform being used if the floor of the workroom is not level. The subject stands facing the observer with hands on the hips, feet together, and weight evenly distributed. The observer ordinarily finds it convenient to sit or squat in front of the subject.

3. *Weight.*—The subject is asked to stand quietly on the center of the platform of the scale with hands on the hips. He is instructed not to shift his body while the reading is made.

4. *Stature.*—The subject stands on the leveling platform with heels against the wall and together. The shoulders and buttocks just touch the wall. The eyes are directed forward, and the head is erect. The palms of the hands lie on the thigh. The observer stands at the subject's right side. The measurement is taken with the anthropometer, and a perpendicular wallboard is used when a suitable wall, free of baseboard and paneling, is not available in the workroom.

The anthropometer is held and balanced in a vertical position in the right hand. The left hand locates the top of the head while the right hand slides the moving arm of the anthropometer down to rest there. Sufficient pressure is used to bring the point of the anthropometer to the level of the top of the head.

5. *Height of cervicale.*—The subject's position is identical with that described for the measurement of stature, except that the subject stands away from the wall toward the outer end of the leveling platform so that the anthropometer can be placed back of him. The observer stands back of the subject and to his left side. The anthropometer is held vertical in the right hand in line with the center back. The straight edge of the brass point piece is directed toward the floor. The point is lowered to the cervicale. The measurement is taken quickly before the child alters his position. The anthropometer is used for this measurement. The leveling platform will be required if the floor of the workroom is not level.

6. *Height of tibiale.*—The upper section of the anthropometer is used. If the floor of the workroom is not level, the subject stands on the leveling platform. He places his left foot on a chair which raises the foot about to the level of the midregion of the right kneecap. The subject's weight is evenly distributed between the two feet. So far as possible, the main axis of the right leg is perpendicular to the floor. The right foot is directed straight forward. The observer squats at the subject's left side with eyes at the knee level. The upper section of the anthropometer is inverted so that it stands on the fixed arm. The straight edge of the brass point piece is directed toward the floor. The point is raised to the level of the tibiale. The reading is taken at the upper margin of the brass collar of the movable horizontal arm of the anthropometer.

7. *Height of crotch.*—The upper section of the anthropometer is used; but if the floor of the workroom is not level, the leveling platform is used. The subject's position is the same as for the measurement of the height of tibiale. Before the left foot is raised to the chair, the subject is asked to pull up the measuring suit by the waist band in order to bring the garment in snug contact with the perineal floor. The principal transverse axis of the pelvis is approximately horizontal to the floor. The observer



squats at the center back of the subject with eyes at the level of the fold of the buttocks.

The anthropometer rests on the fixed arm. The brass point piece is raised in the crotch until its straight edge is at the level of the base of the left buttock. This level is indicated by placing a pencil under the left buttock, tangent to the buttock at its lowest point and parallel to the floor. The straight edge of the brass point piece is brought to rest on the pencil at this level of the left buttock. Caution is exercised in order not to tip the pencil from its horizontal position, nor exert more than moderate pressure on the under surface of the buttock.

8. *Bitrochanteric diameter*.—The upper section of the anthropometer is used for this measurement. The subject stands as for the measurement of stature except that he is away from the wall and bands are placed on the hips. The weight is distributed equally on both feet. It is usually convenient for the observer to sit in front of the subject.

The straight edge of the brass point piece faces the fixed arm of the anthropometer. The shaft and arms of the anthropometer lie in a plane parallel to the floor. The midpoints of the inner surfaces of the arm are placed on the hip landmarks. The anthropometer is closed without pressure on the skin and the reading made at the inner margin of the brass collar of the movable arm of the instrument.

9. *Slope of shoulder, right*.—The subject stands in the same position as for the measurement of the cervicale, with arms relaxed and hanging at the sides. The observer stands in back of the subject and to his right side. The wooden blade of the protractor is rested on the intersection of the shoulder line and the right armseye. The subject is asked to carry the weight of the instrument on his shoulder without altering the position of the shoulder.

The intersection of the shoulder line and the armseye is used as the pivotal point, and the opposite end of the wooden blade of the protractor is lowered to the point where the shoulder line and the neck base intersect. The instrument should rest lightly without depressing the skin. It is balanced easily on the landmark while the left hand is used to steady the instrument and the right thumb and index fingers adjust the spirit level to a horizontal position. If the protractor cannot be brought to rest on the intersection of the shoulder line and the armseye because of the interference of higher points, the blade is poised on the highest point; but the blade's direction is that of the shoulder line.

10. *Width of chest, front*.—The subject's position is the same as that taken for the measurement of stature except that he stands away from the wall. The observer is in front of the subject with eyes at the level of the measurement. Sitting or squatting may be necessary when measuring the younger groups.

The observer tells the subject that this measurement and the three following immediately are to be made while he stands in the same position. It is essential that the subject's position corresponds with the standard position for stature and that the position be maintained throughout the set of four measurements. The upper border of the tape is rested at the level of the landmark previously made on the front of the chest. The measurement is made from the line marking the armseye on one side to the outline of the other armseye. The upper border of the tape is held horizontal. It may be necessary to elevate the zero and reading points of the tape in order to bring its upper edge into a horizontal position.

11. *Length of waist, front*.—The subject's position is identical with that described in the preceding section. The zero point of the tape rests at the landmark made at the neck base, and the reading is made at the average waist level in the center front, previously marked.

12. *Width of chest, back*.—The subject's position is identical to that taken for the measurement of width of chest, front. The observer is back of the subject, standing, sitting, or squatting so that his eyes are at the level of the measurement. The upper border of the tape rests at the level of the landmark made on the spinous process of the fourth thoracic vertebra and is made to lie in a horizontal plane by elevating the zero and reading points of the tape as needed. The measurement is taken without constriction and is made from the line marking the armseye on one side to the outline of the other armseye.

13. *Length of waist, back*.—The position of the subject is identical to that described for the measurement of the width of chest, front. The observer is back of the subject and to the left side. The zero point of the tape is placed at the landmark at cervicale. The tape follows the outline of the center back without constriction, and the reading is made at the landmark at the average waist level in the center back.

14. *Girth of the chest at the armseye*.—The subject's position is his normal erect posture. The observer stands back of the subject. The tape is placed around the trunk without constriction, with the zero point at the center back. The upper border of the tape rests under the arms at the level of the landmark of the armseye on the trunk and passes through the underarm midpoints of the left and right armseyes, as previously marked. When the subject's arms are raised slightly in order to place the tape in proper position in relation to the underarm midpoints, the tape should be somewhat slack in the front. If this precaution is observed, the tape will not constrict the chest muscles when the arms are lowered. If the subject elevates his shoulders, he should be asked to relax them.

When the tape has been placed so that its upper border passes through the landmarks of the underarm midpoints and the girth is set without constriction, the observer passes around to the side of the subject to check the relative positions of the back and front arcs of the girth. The two arcs should lie horizontal to the floor. It is frequently necessary to lower the arcs and set the tape more loosely. The subject breathes normally and the middle value between the largest and smallest reading is recorded. Before removing the tape the level of its upper border is marked in the back by a dot in the center of the body. In this way the approximate level of the underarm midpoints is taken on the back and a landmark is provided for the measurement to follow.

15. *Depth of scye*.—The subject assumes a normal posture with head erect and eyes directed forward. The observer stands at the center back of the subject. The zero point of the tape is placed on the landmark at cervicale. The subject should be cautioned not to lower his head. The reading is made at the landmark placed in the center of the body during measurement No. 14. This landmark gives the position of the border of the tape when the latter was placed for the measurement of the girth of chest at the armseye.

16. *Back arc of hips*.—The subject stands erect with feet together, weight evenly distributed, and hands on the hips. The observer squats back of the subject with eyes at hip level. The zero point of the tape is placed at the hip level of the left side. The upper border of the tape lies in a horizontal plane. The reading is made on the right thigh at the hip level, the measurement being taken without constriction.

17. *Maximum girth of chest*.—The subject's position is his normal erect posture with feet together. The tape is passed around the chest so that the upper border is at the level previously marked for the measurement of the maximum girth. The zero point is at the center front or center back depending upon the position of the landmarks.

(See p. 21.) The front and back arcs of the girth should be horizontal to the floor. The girth is measured without constriction. This measurement is omitted on boys younger than 11 years of age and girls younger than 10. If the level of the girth of chest at the armseye as marked is the same as that indicated for the maximum girth, the reading for the girth of chest at the armseye is recorded for the maximum girth of chest as well.

18. *Front arc of the chest.*—The subject's initial position is his normal erect posture with feet together, and arms relaxed at the side. The observer should raise the arms of the subject just enough to permit the observer to see the underarm midpoints. The minimum movement to expose these points and yet not disturb their position can be accomplished if the shoulder is not disturbed and the movement of the shoulder is confined to the elevation of the arm. The arms are slightly bent at the elbow. The hands are placed far enough from the side to permit the observer to work between the arms and the trunk. Care is taken that the shoulders are not thrown forward giving the subject a hollow chest appearance and thus reducing the accuracy of the reading. The observer is in front of the subject with eyes at the level of the chest. The zero point of the tape is placed on the landmark at the right underarm midpoint. The upper border of the tape lies horizontal to the floor, and the reading is made at the landmark at the left underarm midpoint.

19. *Girth of the waist.*—The subject's position is his normal erect posture with feet together. The observer is in front of the subject. The tape is placed around the body at waist level with the upper border of the tape passing through the landmarks at the average waist level. The zero point is at the center front. The measurement is taken without constriction. The subject breathes normally. The middle value between the largest and smallest reading is recorded.

20. *Girth of the hips.*—The subject's position is his normal erect posture with feet together and hands on the hips. The observer is at the right side of the subject. When the reading is made the eyes are at hip level. The tape is passed around the body so that the upper border passes through the landmarks made for the average hip level. The tape should be held horizontal to the floor. The measurement is taken without constriction.

21. *Girth of the neck base.*—The subject's position is his normal erect posture. The observer stands to the right side of the subject. The tape is placed around the neck with its lower border passing through the landmark placed on the cervicale. The zero point of the tape lies just back of the intersection of the neck base with the shoulder line. The thin edge of the tape rests on the markings of the neck base of the right and left sides and the center front. The observer fits the tape to the landmarks in succession, releasing each placement after the one following is completed. The tape should describe a smooth, closed curve through the four landmarks. The measurement is taken without constriction and without undue slack.

22. *Shoulder length.*—The subject's position is his normal erect posture with feet together and arms relaxed at the sides. The observer stands back of the subject and to his right side. The zero point of the tape is placed at the landmark where the neck base intersects the shoulder line. The top border of the tape is placed on the shoulder line. The subject should be cautioned against lowering his shoulder and drawing the head away from the tape at its zero position.

23. *Girth of the armseye, right.*—The subject's position is his normal erect posture with feet together and arms relaxed at the sides. The observer is back of the subject and to his right side. The subject's arm is raised sufficiently to permit the observer to place the tape under the arm so that the thin edge passes through the underarm

midpoint and the zero point falls just below the armseye at the back. The case end of the tape is brought up over the shoulder, and the case is allowed to drop over the back, thus providing the tension for this measurement. The folds of skin at the front of the armpit are eased under the tape. The tape is fitted to the back and front of the armseye as well as to the landmark where the armseye intersects the shoulder line. The looped end of the tape is raised without unduly hindering the skin folds at the back of the armpit.

24. *Girth of the upper arm, right.*—The subject's position is his normal erect posture with feet together and arms relaxed at the sides. The observer is at the right side of the subject with eyes at the level of measurement. The tape is placed around the upper arm. The girth is taken midway between the shoulder and the elbow without constriction. The tape should be horizontal when the arm hangs relaxed so that the principal long axis of the arm is approximately perpendicular to the floor.

25. *Girth of the elbow, right.*—The subject stands in a normal, erect position. The right arm is bent at the elbow, and the hand and fingers extended forward. The angle of the elbow is approximately 90° with the upper arm directed straight downward. The observer is at the right side of the subject and with eyes at the level of the measurement. The tape is placed around the arm so that it passes over the landmark made on the elbow and bisects the angle of the bent elbow. The zero point is in front of the observer. The measurement is taken without constriction.

26. *Length of right arm, upper segment, back surface.*—The subject stands in a normal erect position with feet together. The right fist is placed on the hip, with the back of the hand toward the front of the body. The arm is not bent at the wrist. The observer stands to the back of the subject, at his right side. The zero point of the tape is placed at the point where the armseye intersects the shoulder line. The reading is made at the landmark previously placed at the elbow. The tape is continued over the elbow to the wrist.

27. *Total length of right arm, back.*—The subject's position is identical to that assumed for measurement No. 26. The observer stands to the right side and back of the subject. When the reading is made, the observer bends down under the point at the wrist so that the reading is made in the direct line of vision. The zero point of the tape is placed on the landmark where the armseye intersects the shoulder line. The tape passes over the elbow to the landmark at the distal end of the ulna, at the wrist (fig. 7). The measurement is taken with sufficient tension to maintain the tape in position at the elbow.

28. *Trunk line, right.*—The subject's position is normal erect posture with feet together. The observer asks the subject to relax his right arm and shoulder and permit him to place the arm in the desired position. The forearm is bent at an angle of 90° to the upper arm, and the hand is extended directly forward. While the observer steadies the subject's shoulder, he moves the entire arm thus bent, an inch or so directly forward. The observer, still steadying the shoulder, then grasps the bent elbow and tips it slightly upward until the underarm midpoint is just visible when the observer's eyes are at the level of the midtrunk. The object of this detailed procedure is to expose the underarm midpoint without moving it significantly from its position when the arm hangs loosely at the side. The observer sits at the right side of the subject with eyes at the level of the middle region of the trunk. The zero point of the tape is placed at the underarm midpoint. The tape passes directly to the landmark placed at the average waist level. If the subject is wearing a handkerchief the tape may pass over or under the garment, whichever will disturb less the direct course of the tape between the landmarks.

29. *Length from waist to hip, right.*—The position of the subject and observer in taking measurement No. 28 is maintained. The zero point of the tape is placed at the landmark of the average waist level. The tape passes over the measuring garment, and the reading is made at the landmark placed at the average hip level.

30. *Maximum girth of the thigh, right.*—The subject's position is his normal erect posture with hands on the hips. The feet are parted slightly to permit the tape to pass freely between the thighs. The observer is at the subject's right side with eyes at the level of the folds of the buttocks. The tape, which is placed around the thigh with the upper border at the level of the fold of the buttock, is horizontal to the floor. The zero point is situated directly in front of the observer at the right side of the subject's thigh. The observer passes to the front of the subject after the tape is placed to see that the tape is in the proper position. If the fold of the buttock is not distinguishable, it can be found by pressure on the right buttock. However, several folds may be so produced and the major one of these must be selected provisionally. The tape passes over the thigh at its largest point. The measurement is taken without constricting the thigh.

31. *Maximum girth of calf, right.*—The subject's position for measurement No. 30 is maintained unaltered. The observer squats at the right side of the subject with eyes at the midlevel of the tibia. The tape passes around the calf at the level where the observer judges the girth to be maximum. The level is determined by looking at the back profile of the calf. The tape is held horizontal to the floor, and the measurement is taken without constriction of the calf.

32. *Girth of the knee at tibiale, right.*—The subject's position is the same as that described for measurement No. 31. The observer squats in front of the subject with eyes at the level of the tibiale. The tape is placed around the knee with the upper border at the level of the tibiale. The zero point is at the center front. The tape is held horizontal to the floor. The measurement is taken without constricting the knee.

33. *Length of crotch, total.*—The subject is asked to pull up the measuring suit by the waist band to insure a snug adjustment of the suit at the crotch. The left foot is placed on a stool or other steady object which elevates the left foot to the level of the middle of the right kneecap. The weight is evenly distributed between the two feet. The long axis of the right leg is approximately perpendicular. The right foot is directed straight forward. The left hand rests on the left thigh. The head and trunk are erect. The principal transverse axis of the pelvis is approximately horizontal. The observer is at the left side of the subject while placing the zero point. He is at the center back with eyes at average waist level when the reading is made.

The zero point of the tape is placed at the landmark on the average waist level in the front. The subject holds the tape in position with two fingers flat against the abdomen and spread so that the position of the zero point

can be checked without moving the fingers. On very young children the observer holds the zero point of the tape in position. The tape passes centrally over the genitals and floor of the crotch to the landmark of the average waist level in the back. The tension of the tape is about that provided by the weight of the tape case.

34. *Length of the crotch, front.*—The subject's position taken for measurement No. 33 is maintained. The observer squats at the subject's left side with eyes at crotch level. The zero point of the tape is placed at the landmark at the average waist level in front. When the reading of the total length of crotch has been made (measurement No. 33), the observer drops the tape from the average waist level in the back to the crotch level. There the tape is supported on the observer's left index finger, and the case hangs free, providing the tension desired for this measurement. The tape is lowered from the floor of the crotch by the width of the tip of the observer's index finger so that the observer can grasp the tape between the index finger and thumb at the middle landmark of the thigh. This landmark is the reading point for measurement.

35. *Extreme bend.*—The subject stands with feet together facing a chair or stool about 2 feet away. He bends over at the hips and grasps the leg of the chair, or otherwise brings his hands to rest so that they are approximately at the middle or lower border of the kneecap. The head is allowed to drop forward. The legs are straight and perpendicular to the floor. It is necessary to adjust the position of the chair so that the legs and arms can be brought to the desired position without discomfort for the subject. The observer is back of the subject. He squats with eyes at knee level while the direction of the tape is checked and the reading is made. The zero point of the tape is placed at the point of the average waist level midway between center back and right side. The tape passes without constriction over the buttocks to the midpoint of the knee at the back. Throughout its course the tape is equidistant from the center line of the body; that is to say, the arc of the tape, although fixed at the landmarks, does not swing to either side or to the middle. The reading is made at the landmark midpoint of the knee in the back.

36. *Trunk girth, vertical.*—The subject is asked to pull up the measuring garment by the waist band. His position is his normal erect posture. The feet are placed slightly apart so that the tape can pass freely between the thighs. The observer is in front of the subject with eyes at the level of the nipples. With younger subjects it is convenient to sit down. About 1 m. of tape is drawn from the case. The zero end of the tape is passed midway between the landmarks of the neck base and the armseye. In the back, the tape passes between the buttocks. In the front, at the crotch, the tape passes centrally over the genitals without constriction. Before the reading is made, the subject is asked to relax his shoulders to their normal rest position. The subject breathes normally. The middle value between the largest and the smallest reading is recorded.

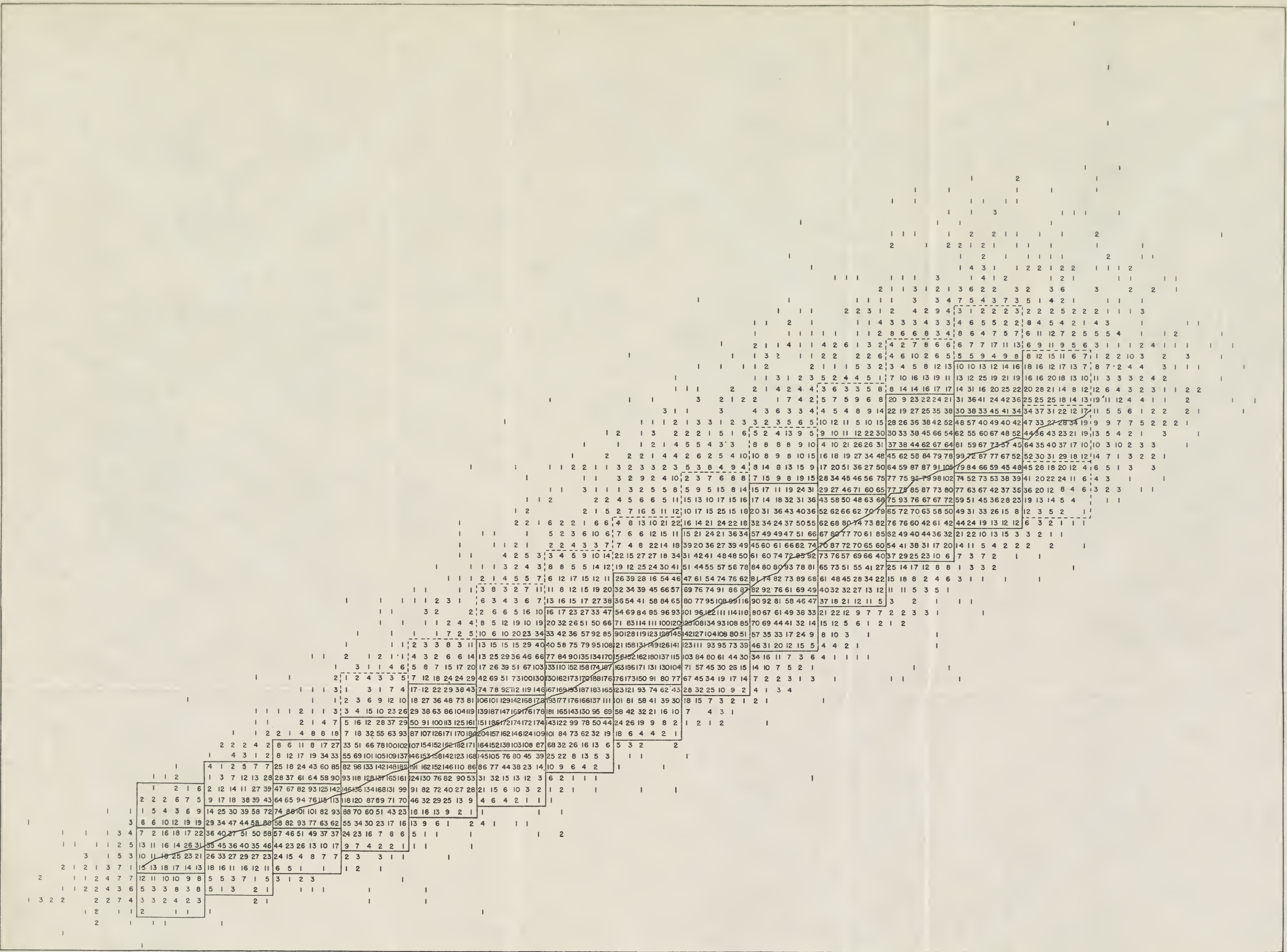






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STATURE (CENTIMETERS)

FIGURE 1.—Distribution of boys 4 to 17 years of age on the basis of stature and girth of hips.

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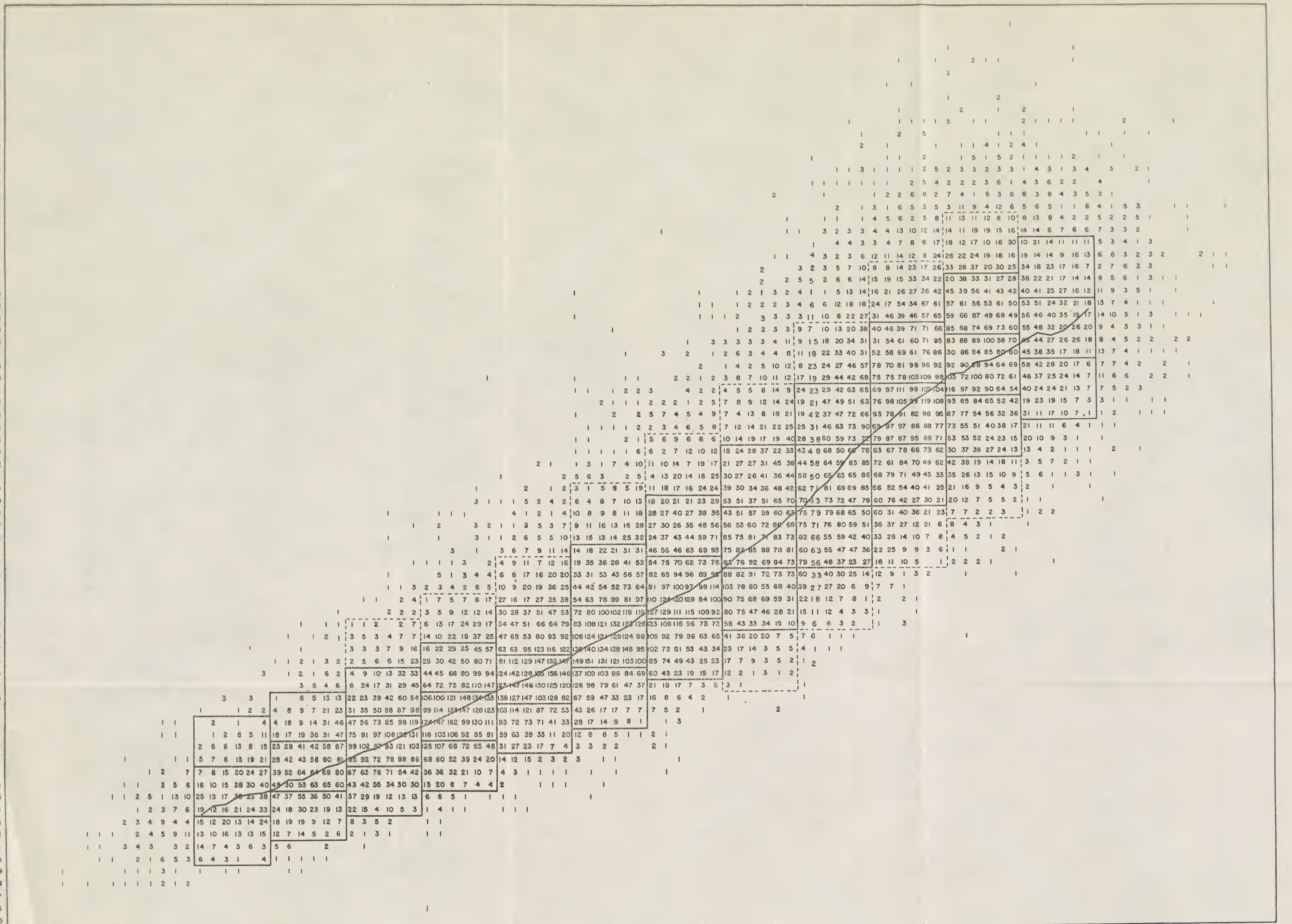






GIRTH OF HIPS (CENTIMETERS)

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STATURE (CENTIMETERS)

FIGURE 2.—Distribution of girls 4 to 17 years of age on the basis of stature and girth of hips.

